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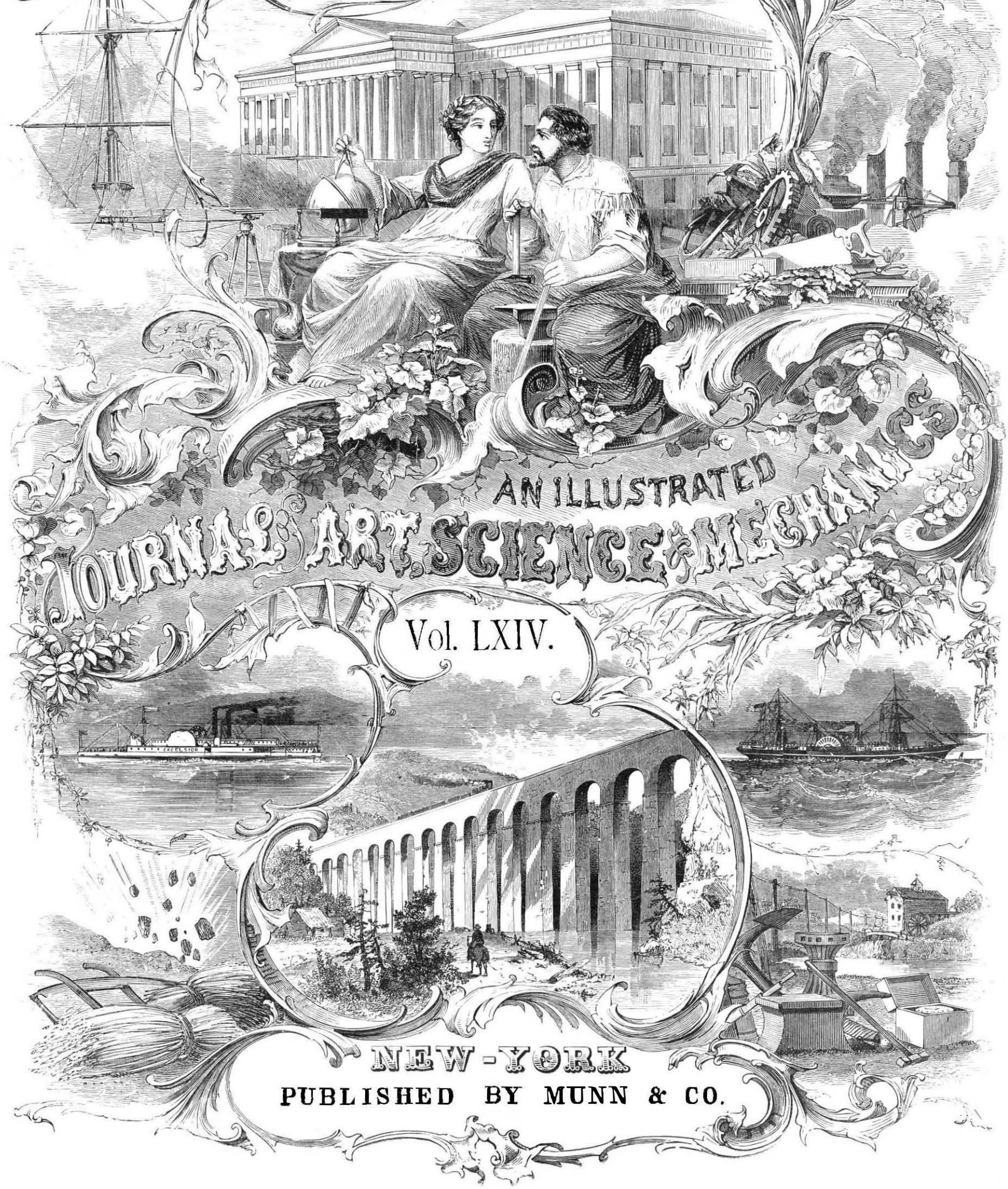

AN ILLUSTRATED JOURNAL OF ART, SCIENCE & MECHANICS

Vol. LXIV.

NEW-YORK

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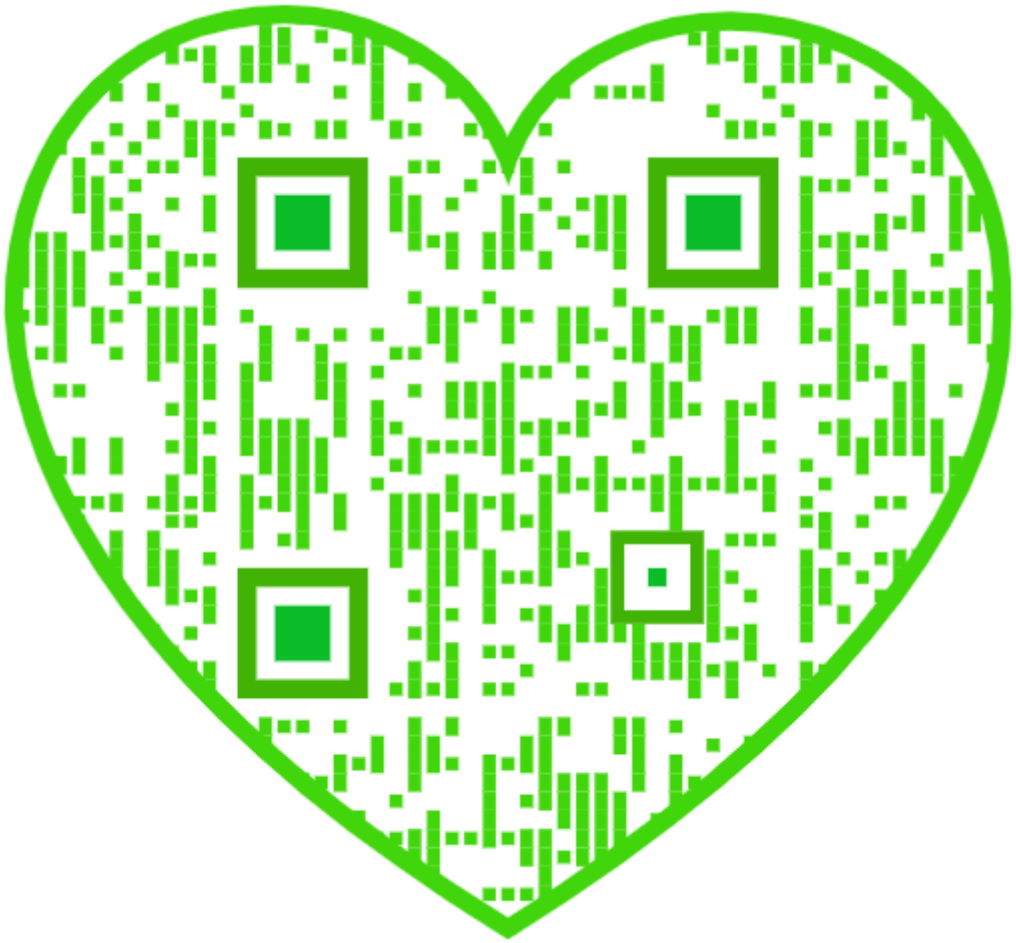

SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

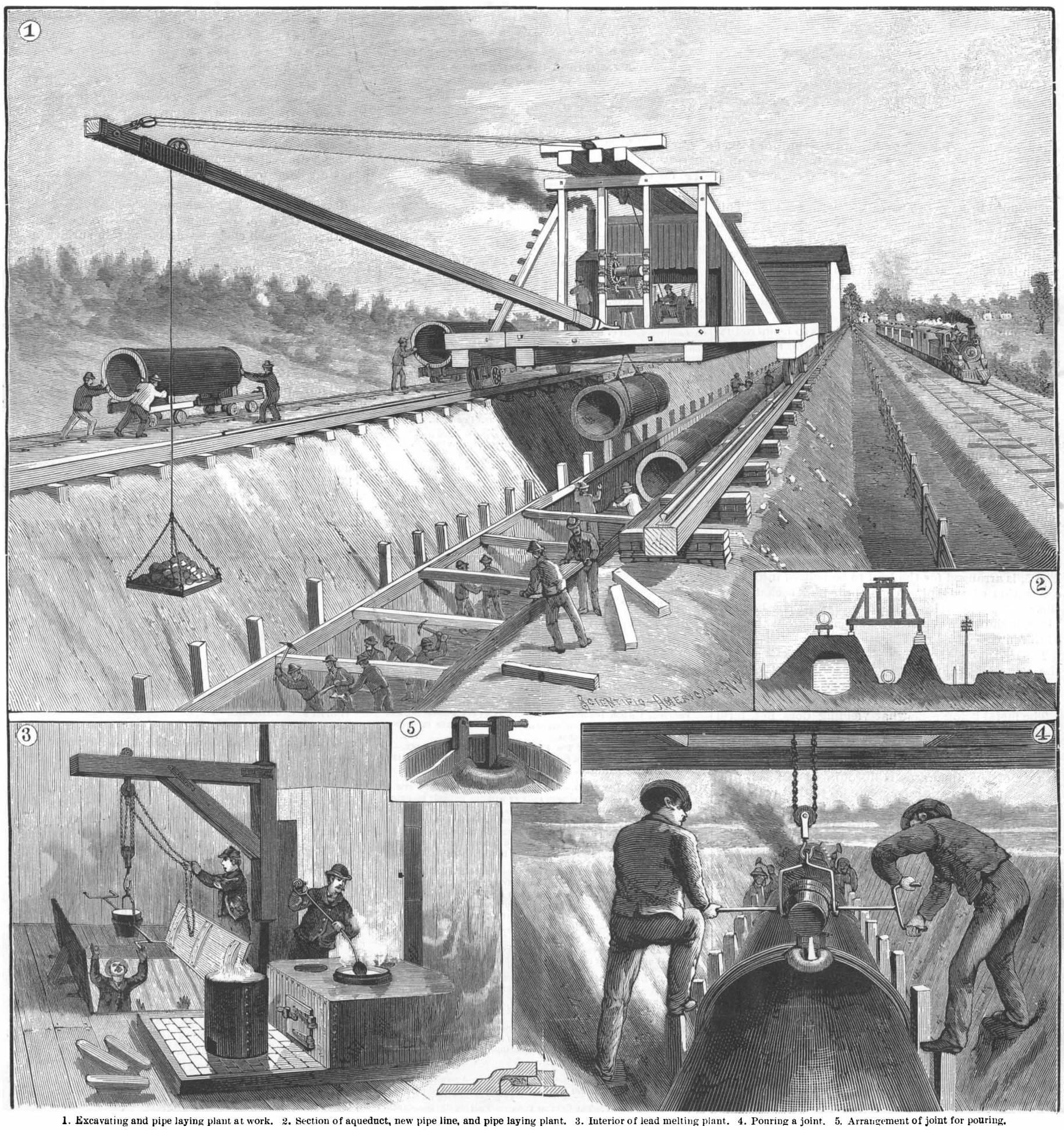
Vol. LXIV.—No. 1. ESTABLISHED 1845. NEW YORK, JANUARY 3, 1891. $3.00 A YEAR. WEEKLY.

EXCAVATING AND PIPE LAYING APPARATUS IN USE ON THE BROOKLYN AQUEDUCT.

The operation of laying large pipe lines has hitherto been conducted by rather primitive appliances. The operations have generally been to a great extent manual, and little more than a derrick placed over the trench for swinging the pipes into place has been used in the way of machinery. The labor of laying such mains has been very severe, and progress necessarily slow, as the work is limited to one point of attack. To secure a consecutive line without sleeve connections the work must be advanced length by length, always in the same direction and without intermediate portions being laid in advance. The apparatus we illustrate has been used with great success upon the Brooklyn, N. Y., water works, in laying a new line of forty-eight inch pipes. As the sections or lengths of pipe weigh from 7,000 to 8,000 pounds each, the capacity of the machine has been somewhat severely tested. It has, however, worked most successfully, laying from two hundred to three hundred feet per day.

The apparatus consists in general of a hoisting apparatus and crane followed by a lead-melting plant, all moving over the trench. The two are separate and independent of each other's movements. They are carried by rails, a single line of which runs along each side of the trench. In advance of the whole arrangement the excavation is kept in progress. The trench diggers work as long as practicable by throwing the earth out by hand. As the depth increases, the crane carried in advance of the hoisting plant is brought into play. It is used to elevate the earth from the trench and to swing it to one side. This operation is shown in Fig. 1 of the engraving. As fast as necessary, the apparatus is moved forward on the rails by pinch bars.

Along one side of the trench a portable railroad has been laid. This serves for cars to run upon to carry off the dirt from the excavation where necessary, and



1. Excavating and pipe laying plant at work. 2. Section of aqueduct, new pipe line, and pipe laying plant. 3. Interior of lead melting plant. 4. Pouring a joint. 5. Arrangement of joint for pouring.

EXCAVATING AND PIPE LAYING APPARATUS IN USE ON THE BROOKLYN AQUEDUCT.

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to bring pipes to be laid in the trench. In Fig. 2 of the engraving the relations of trench, pipe-laying plant, and portable railroad are clearly shown. Below the pipe-laying apparatus the new line of water main is indicated lying at the bottom of the excavation.

The pipes, as fast as required, are run up to the scene of operations upon the portable railroad. The hoisting apparatus consists in general terms of a rectangular platform carried on four wheels and extending over and across the trench. Through its floor a longitudinal opening is arranged, directly over the center of the excavation, large enough for a pipe to pass through in a horizontal position. The superstructure serves as support for the jib tackle of the crane and to carry pulleys, etc., for handling the pipe. As the length of pipe is run alongside, skids or short timbers of wood are laid from the car to the platform, and a pair of skids are also laid across the opening over the axis of the trench. Two or more ropes are brought from the platform to the car, passing under the pipe and then partially around and over it, returning to the upper framework. At this point they pass through pulleys and are brought to the floor, where there is a steam windlass, which is seen mounted on the platform. On drawing in the ropes, the pipe, it is obvious, will be rolled up the inclined plane formed by the skids, and can be brought directly over the trench. The arrangement is what seamen call a common "parbuckle." It is often used in the city in lowering heavy barrels into cellars.

Slings are then placed around the pipe now lying on the skids over the aperture. Tackle is hooked on, and it is lifted a little by the steam windlass, and the skids are withdrawn. It is then lowered into the trench. This stage of operation is shown in the cut. As it descends, the pipe layers guide it into position. Its small or spigot end is entered into the hub or socket of the preceding length, and it is blocked up in a horizontal position in line with the work. This ends this stage of operations.

The joint has next to be calked with oakum. This is driven by hand with a calking iron. It extends all around the pipe within the hub, and is of as even thickness as possible. It forms a base for the lead, which latter is the actual joint-making material. It should be noted that there is a slight space left between the abutting ends of the pipe to allow for changes of temperature.

To complete the joint melted lead has to be introduced into the space in front of the oakum and the lead in turn has to be calked. As the apparatus just described is moved forward, the lead-melting plant seen in its rear is moved into its place. This consists of a house with furnace and lead pot, ladle, and crane. Its interior is shown in Fig. 3, the men being engaged in lowering a ladle full of melted lead. Next to the large furnace is a smaller circular furnace. This is used to keep the ladle hot when it is not in use.

The lead is lowered, as shown, into the trench, where it is received by the pipemen and poured into the joint, as shown in Fig. 4. Before doing this a band of iron hinged at the bottom is placed around the pipe and bolted at the top, so as to inclose the annular space in front of the oakum. A clay mouth or funnel, Fig. 5, is arranged for the lead to be poured into. The connection of two pipe ends, hub and socket, with their oakum and lead filling, and with the band in place, is shown in the small sectional view at the foot of the cut.

The lead at once solidifies. The band is removed, and the calkers attack the lead with large-faced calking irons and hammers and drive it home. This operation expands the lead and makes it fill the joint perfectly.

The metal being somewhat yielding does not form too rigid a connection, and allows for changes of temperature. In spite of numerous attempts, lead-calked joints have never been displaced. The trench in rear of the apparatus is filled in as fast as it progresses, and the work is complete up to that point.

The object of the line is to carry water from the new reservoir between Rockville Center and Baldwins, on the south side of Long Island, to the Ridgewood reservoir and new pumping station at East New York. It will be a pressure line, and will have a capacity of twenty-five millions of gallons per day. It follows the line of the old aqueduct for part of the way. The sectional view, Fig. 2, shows the aqueduct full of water on one side of it. The aqueduct embankment is thus, in part, utilized in its construction.

The work is being executed by Mapes, Crawford & Valentine, of Brooklyn, N. Y. They are the designers of the ingenious and efficient apparatus whose results have taken the direction of greatly accelerating the work we have described.

PROFESSOR ORTON, State Geologist of Ohio, says that the natural gas supply is rapidly and surely being exhausted. The way in which the gas is wasted makes the average stranger sick at heart. Great roaring wells, huge batteries of the cheapest and most wasteful types of boilers blowing off steam night and day, empty furnaces kept hot for weeks at a time, strike him as crimes against the economy of nature.

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THE NEW CRUISER NEWARK.

On the 22d of December the new U. S. steel cruiser Newark had her official trial trip, and proved a great success, the contract requirements being exceeded by about five hundred horse power. This was developed in a continuous run of four and a half hours, at the end of which time the machinery was running more smoothly and the engines developing more power than at the commencement of the trial, a result which is seldom obtained on first pushing a new boat to its best performance. The steam pressure was kept at 161 and 162 pounds, the maximum revolutions of screw made were 129·2 per minute for fifteen minutes, the engines vibrating very little, and the firerooms were cool, rendering the firemen's work comparatively easy. The builders are to receive $100 bonus for each horse power developed over 8,500, and it is confidently expected that the final figures will show that 9,000 horse power was developed on the trial. The builders, the Messrs. Cramp, of Philadelphia, and the officials of the Navy Department, were greatly gratified at the good showing made by the vessel, and in this feeling, it is hardly necessary to say, the people generally share, as there are few subjects which attract a more widespread or a keener interest than is manifested concerning each forward step taken in the development of our new navy.

The Newark's hull is the same as that of the San Francisco, whose fine lines have commanded much admiration, and which was illustrated and described in the SCIENTIFIC AMERICAN of October 18, 1890. The engines of the Newark are smaller, however, and are horizontal. The machinery is protected by a steel sloping deck, two inches thick on the top and three inches thick on the sides. The length of the vessel between perpendiculars is 300 ft. 10 in., length on water line 310 ft., and length over all 327 ft. 7 in.; extreme beam, 49 ft.; depth of hold, 28 ft. 8 in.; mean draught 18 ft. 9 in.; displacement 4,090 tons. There are four main cylindrical, double ended, return tube boilers, with four firerooms, and two smoke pipes, each 6 ft. 6 in. in diameter. The boilers are each 19 ft. 5 in. long, and 13 ft. 6 in. in diameter, with three corrugated furnaces at each end, and a total grate surface of 540 square feet. There are two horizontal, direct acting, twin screw triple expansion engines, each in a separate compartment. The cylinders are 34, 52, and 76 inches in diameter, respectively, with a 40 inch stroke. The shafts are hollow steel, the crank shaft being fourteen inches in diameter with a four inch hole, while the after section of the propeller shaft has an eight inch hole. The coal capacity of the vessel is 830 tons, which is disposed of in fifty-three different coal bunkers. She will burn four to five tons of coal per hour when pushed to her utmost limit.

The armament of the Newark will be twelve six inch breech loading rifles; four rapid fire guns, two three-pounders and two one-pounders; four revolving cannon and four Gatling guns. There are also six torpedo launching tubes. Three steel masts are adapted to carry fore and aft sails, and the fore and main mast have military tops.

OFFICIAL PROCLAMATION OF THE GREAT FAIR.

The last act necessary to start into booming activity the gigantic works pertaining to the great fair has been performed. The presidential proclamation has been issued, and soon we shall see holes in the ground and structures in the air. The following is the text of the proclamation:

"By the President of the United States of America:

"A proclamation: Whereas, satisfactory proof has been presented to me that provision has been made for adequate grounds and buildings for the uses of the World's Columbian Exposition, and that a sum not less than $10,000,000 to be used and expended for the purposes of said exposition has been provided in accordance with the conditions and requirements of section 10 of an act entitled 'An act to provide for celebrating the 400th anniversary of the discovery of America by Christopher Columbus by holding an international exhibition of arts, industries, manufactures and the products of the soil, mine and sea, in the city of Chicago, in the State of Illinois,' approved April 25, 1890.

"Now therefore I, Benjamin Harrison, President of the United States, by virtue of the authority vested in me by said act, do hereby declare and proclaim that such international exhibition will be opened on the first day of May, in the year 1893, in the city of Chicago, in the State of Illinois, and will not be closed before the last Thursday in October of the same year. And in the name of the government and of the people of the United States, I do hereby invite all the nations of the earth to take part in the commemoration of an event that is pre-eminent in human history, and of lasting interest to mankind, by appointing representatives thereto, and sending such exhibits to the World's Columbian Exposition as will most fitly and fully illustrate their resources, their industries, and their progress in civilization.

"In testimony whereof I have hereunto set my hand and caused the seal of the United States to be affixed.

"Done at the City of Washington, this twenty-fourth

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day of December, 1890, and of the Independence of the United States the one hundred and fifteenth.

"BENJAMIN HARRISON.

"By the President. JAMES G. BLAINE, Secretary of State."

The proclamation marks an epoch in the Exposition. The work heretofore done has represented the civic organization of the enterprise. Actual erection of buildings could not be commenced in the absence of the governmental sanction, now granted, and which comes just at the time when it is likely to be the most beneficial. The legislatures of many of the States are about to meet and will be asked to take part in the grand display. That all the States will liberally respond there is no question. The commission may now solicit foreign exhibitors to come to Chicago, and the contributions from abroad will doubtless be great and wonderful.

In this connection we would call attention to the very interesting and able lecture upon the Chicago Exhibition recently delivered before the Society of Arts, in London, by Mr. James Dredge, editor of *Engineering*, upon the nature and scope of the great enterprise. We give the paper in full in our SUPPLEMENT of the present week, Number 783. The lecturer presents a brief history of the project of the fair. Its financial basis he considers to be equal to that of the recent Paris exhibition. He then describes the history, situation, resources, population, area, importance, trade, and industries of Chicago, giving a most glowing picture thereof, of which Chicagoans may well be proud. The author next proceeds to describe the grounds selected for the exhibition purposes, namely, Jackson Park, Washington Park, and the broad connecting strip known as the Midway Plaisaunce, the whole comprising an area of 1,200 acres, more than ample for actual requirements.

The selection of Jackson Park with its lake front for the location of the great buildings is highly commended. He declares that no such favorable site has been ever placed at the disposal of an exhibition executive. The desirability of European participation is next discussed, and the important benefits likely to be realized by English exhibitors are forcibly stated. But whether a British section is created or not, the author urges every Englishman who can spare the money and time to visit Chicago in 1893, for in no other way can he become so readily informed respecting the vast capabilities and resources of America and her wonderful advances in industry and invention. It is evident the undertaking will be full of the greatest interest to the thoughtful foreign visitor.

In the discussion which followed the reading of the lecture, some most excellent and some quite funny English ideas were expressed, all of which are given in our SUPPLEMENT report.

PROGRESS OF THE GREAT RAILWAY TUNNEL UNDER THE HUDSON RIVER.

Since our last account, published in the SCIENTIFIC AMERICAN of November 1, about 470 feet have been added to the Hudson River tunnel, which brings the total completed length up to 2,720 feet. This indicates a progress at the rate of about 7 feet per day. The work is progressing without interruption. By removing the intermediate accumulating pump, and bringing the power of the pump direct to the hydraulic jacks, the Beach pneumatic shield is advanced the width of one of the rings in eight minutes, a progress formerly requiring from 2 to 4 hours. Formerly, the great trouble was in getting the shield ahead, at present the great obstacle is in getting away the excavated silt rapidly enough. A system of chutes is soon to be tried, one under each opening in the shield front, down which the silt will slide direct into the waiting cars, instead of shoveling it by hand as heretofore. The company hope to record ten feet per day when these changes are completed.

NEW TERMINUS OF PENNSYLVANIA RAILROAD IN JERSEY CITY.

The work of elevating the tracks and terminal structures of the Pennsylvania Railroad Company, at their terminus in Jersey City, has so far advanced as to clearly outline its completion, advantages and defects. Entrance to Jersey City has been effected upon a two-track roadbed. By the present change to the elevated plan, four tracks will be obtained. Beginning at a point back of the city near what is known as Bergen Hill, a slope ultimately merging into an iron superstructure, similar in design to the Sixth Avenue elevated road, has been constructed, to the station at the water front, about one and a half miles. The part so nearly completed is but one-half, or two tracks, of the system, the present road tracks being moved a little one side, that the business of the road might continue until the two elevated tracks are ready for use, after which the other half will be erected and wedded to it.

The structure is a continuous plate II girder in its continuity, including street bridging, with scarcely an exception.

The broad girders and substantial upright columns give an impression of strength and durability, but like its kindred structure in New York, promise is given of a metallic resonance under moving trains that will be burdensome to nerves near its path.

High in the air, at the river front, timbers of massive strength are being put up, as a superstructure for the erection thereon of the iron train shed.

The work so far as accomplished has all the characteristics of strength, but few of beauty, as compared with the terminal approaches at Philadelphia.

On the New York side, work has been commenced in raising the height of the ferry houses to accommodate the two-story boats that are to be used in connection with the elevated structures on each side of the river. This part of the system we described and illustrated in our issue of February 8 last.

Magnetic Rocks and Ships' Compasses.

The following extract from a letter of Profs. Rucker and Thorpe, which recently appeared in the London *Times*, may be of interest:

As it has been suggested that the loss of her Majesty's ship Serpent, lately wrecked at night on the north coast of Spain, may have been due to a deviation of the compass caused by magnetic rocks, we think your readers should be warned that such an explanation should only be accepted after rigorous proof. In the first place, it must be borne in mind that ordinary ironstone is not magnetic. Metallic iron and the magnetic oxide are practically the only substances which could affect the compass to an appreciable extent. Large disturbances generally occur in the neighborhood of basalts, gabros, and the like, throughout which magnetite is scattered in a more or less finely divided state. Such rocks are plentiful on the west coast of Scotland, and on the island of Canna there is a cliff named Compass Hill, from the great effect which it produces on the magnet. . . . We have made a special study of the magnetic properties of this island, and can confirm the statement that its basaltic cliffs are powerfully magnetic. The needle of a compass placed near them may be deviated by two points. The effect, however, diminishes very rapidly with the distance, and is inappreciable on a ship's compass 200 yards from the base of the hill to which tradition ascribes, and in which we have ourselves detected, the most powerful magnetic properties. We have tested this on more than one occasion. In particular, in 1888, we approached the island from the north. The course was magnetic S. ¼ E., a direction most favorable for the detection of the effect of Compass Hill. We passed it within 200 yards of the shore, but observed no effect on the compass. . . . Nowhere in the United Kingdom have we discovered a disturbance which extends for a mile and also produces throughout that distance a constant deviation of the compass of as much as a couple of degrees. While, therefore, it is difficult to assign any limit to what might occur in an extraordinary and special case, and while we believe that there are some well-authenticated instances of magnetic rocks affecting seriously the compasses of ships in their immediate neighborhood, the greatest caution ought to be exercised in accepting any such instance as proved. It is contrary to general experience that intense local magnetic disturbances should also be far reaching.

White Ants in India.

That species of Termes known as the white ant is very abundant in India, and is dreaded by all European residents, on account of its extraordinary ravages, especially in the larva state, in which it is truthfully called a worker.

The workers unite in colonies of countless numbers and take up their abode in the ground, in wood, on the ceiling or roof of a house, making tunnels and forming routes which lead to the center of their nests.

Their deeds are deeds of darkness, for so ingenious are they that they form the tunnels inside and leave the surface of the door or beam intact.

I was standing by the door of our parlor, says C. M. Wherry, in the *Graphic* (Chicago), talking to a friend, and on putting my hand upon the door frame, found that it was hollow. On further examination it was found to be filled with earth along one side, which the Termes had deposited as they worked their way through.

One morning our sweeper removed a pile about two feet in height from our dining room floor, but the energetic creatures, nothing daunted, began their work over again, and by the next morning the pile was a yard in height from the floor and up the side of the wall.

Day after day the sweeper wielded his broom over the spot until he was forced to the conclusion that they meant to conquer him.

As a last remedy, after a great many experiments, he poured a gallon of kerosene over the spot and was exceedingly rejoiced to find that at last they had been driven away after two weeks of hard fighting. But alas! his spirits sank within him when one morning a few days later he found the pile higher than ever.

It became necessary to dig for the queen, as after her expulsion no more are hatched, and they gradually disappear. A hole in the cement floor was dug in which a horse could have been buried, before the queen was found in the center of her colony.

The abdomen of the queen becomes very much distended with the innumerable eggs which it contains. It is said that one such insect has been known to deposit 80,000 eggs in one day. The larvæ are a creamy white and transparent enough to show the substance in the body with which the tunnels are moistened when in construction.

After a time they acquire wings, and flying about during the night, lose them. Being particularly attracted by lamp light, many swarm around the drawing-room lights until the floor is quite littered with the wingless creatures, which soon become the prey of lizards and toads, and by daylight, of birds. The natives do not eat them as the Africans do.

On account of their secret ravages, the houses of Europeans and of most natives are usually only one story high, with plastered floors and roofs of earth or grass, which can be renewed every few years.

I have known of people being severely injured by the falling of a heavy mud roof, caused by the white ants having eaten out portions of a heavy beam. So common are they, that railroad ties and telegraph poles are often made of iron, as nothing but metal seems to be impervious to their waste.

Trunks and boxes must be kept off the floor, on bricks at each corner, or on stands made for the purpose. It is a common occurrence to walk into a room some morning and find a carpet eaten in several places, or a box of clothing tunneled through and through, from which you could not get a square large enough for a table napkin. Thus a housekeeper's life becomes one of everlasting vigilance.

American Cars and Locomotives for Foreign Railways.

Two complete trains of drawing room cars have just been completed for the Buenos Ayres and Ensenada Port Railway Company by the Gilbert Car Manufacturing Company, of Troy, N. Y., U. S. A., and St. Ermin's Mansions, Westminster, England. Each train consists of four saloon cars, two ladies' cars, one buffet and smoking car, and one baggage car. The extreme length of cars is 65 feet, with the exception of baggage car, which is 53 feet by 9 feet 10 inches wide. The gauge of rails is 5 feet 6 inches. The whole of the material is of the highest class, and the cars are of handsome design and finish.

The government of New South Wales has placed with the Baldwin Locomotive Works an order for twelve ten-wheel passenger locomotives, somewhat similar to the engines of the same type built for the Baltimore and Ohio, and now running very successfully on that road. The *Railroad Gazette* says limited weight—on account of the bridges—makes it necessary to reduce the dimensions somewhat, while the specification of materials is altered to conform to the practice of the New South Wales government. Thus, the fire boxes will be of copper, tubes of brass, staybolts of copper, and possibly the wheel centers will be of wrought iron. The specifications are not yet fully determined. The engines will have screw reversing gear. The service for which they are intended is to haul passenger trains weighing 144 gross tons—2,240 pounds—at a speed of 22 miles per hour up a grade of 176 feet per mile, or trains weighing 176 gross tons at the same speed up grades of 130 feet per mile, there being curves of 528 feet radius on the 130 foot grades. In all important respects the engines will conform to American practice. These engines are to be built with the utmost dispatch and shipped direct to Sydney by steamer.

Colorado Electrical Street Railways.

Electricity as a street car motor is rapidly superseding other mediums in Western cities.

Denver has already thirty miles of electrical street road in operation, employing an aggregate of 1,150 horse power of generators, 58 motor cars, each fitted with two 15 horse power motors, and 60 trailers, traversing the city and reaching out in every direction to suburban points.

The old cable and horse car companies are rapidly adopting what is apparently to be the motive power of the future for all city and suburban traffic. Several additional electric lines are in contemplation. Some are already in process of construction, notably the so-called Suburban line of 15 miles and the Golden line of 21 miles mentioned in a previous issue.

The West End line uses double-truck cars 40 feet long and of 2,000 pounds weight, fitted with two 15 horse power Sprague motors, this motor and overhead wires being in general use on all the lines.

The Colorado Springs electrical main line, with branches, is 22 miles long, and runs to Colorado City, the former capital of the State; to Manitou, connecting with the new steam railway to the summit of Pike's Peak, altitude 14,150 feet, and to numerous other points of interest. The aggregate power of the generators of this line is 280 horse, employing 18 motor cars and a like number of trailers.

The various lines are all doing a large and an apparently increasing and profitable business.

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THE PHOTOGRAPHIC NECKTIE.

Where will the progress of instantaneous photography end? In view of the admirable results obtained by scientists, and especially by Mr. Marey, inventors have for several years been setting their wits to work to devise small apparatus for allowing amateurs to take photographs without any one seeing them do it. We have already made known the photographic opera glasses and hat; but here we have something cleverer, and designed to meet with great success among practicians: it is a question of a necktie provided with a pin. The latter is an objective, and the necktie is a camera. When any one approaches you and speaks to you at a distance of 2 or even 3 ft., you press a rubber bulb concealed in your pocket, and you have the portrait of your interlocutor.

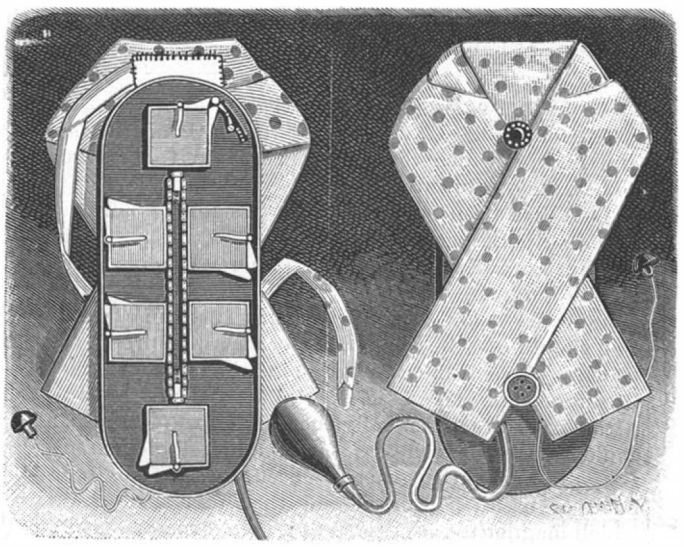
This ingenious little apparatus, with which also general views may be taken, was devised by Mr. Edmond Bloch, who has operated it in our presence, and, although the instrument is not yet being manufactured for sale, we have decided to make it known to our readers at once.

Fig. 1 represents the photographic necktie, and Fig. 2 gives a front view of it as it is to be worn by the operator, the metallic camera, which is flat and very light, being hidden under the vest. Fig. 1 gives a back view, the cover of the camera being removed to show the interior mechanism, comprising six small frames which are capable of passing in succession before the objective, and which permit of obtaining six negatives. The instrument may be constructed with 12 or 18 frames. The apparatus is operated as follows: The necktie having been adjusted, the shutter is set by a pull upon the button, A (Fig. 1, No. 2), which passes under the vest. In order to change the plate, it is necessary to turn from left to right the button, B, which has been introduced into a button hole of the vest, and which simulates a button of that garment. This button must be turned until the effect of a locking, which occurs at C (Fig. 1, No. 1), is perceived, and which puts the plate exactly before the objective. In order to open the latter, it is necessary to press the rubber bulb, D, which has been put into the trousers pocket. The rubber tube, E, passes under the vest and serves to transmit the action of the hand.

In order to charge the apparatus, it is opened at the bottom by turning the small springs, G G G; the sensitized plates are put into the frames, and the springs are turned back to their former position.

The apparatus is scarcely any thicker than the ordinary necktie called "Régate." The camera that contains the plates is not more than 0·2 inch in thickness. The six frames are carried before the objective through an endless chain, as shown in the figure.

Mr. Bloch has shown us some of the photographs that he has taken with this first apparatus, which he considers as yet but an experimental instrument. We reproduce herewith three portraits obtained with the apparatus, Fig. 3, through the minute objective skillfully concealed in the center of the pin. These photographs are about 1½ inch square, and are sufficiently sharp to allow the portraits to be recognized. If this apparatus can be well constructed, we predict a great demand for it.—*La Nature.*



Figs. 1 and 2.—PHOTOGRAPHIC NECKTIE—BACK AND FRONT VIEW.

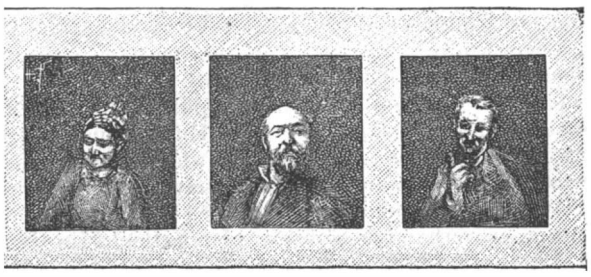


Fig. 3.—FACSIMILE OF PORTRAITS OBTAINED WITH THE APPARATUS.

A COMBINED HARROW AND CUTTER.

The implement shown in the illustration, which forms the subject of a patent issued to Mr. Thomas L. Flanagan, of Vicksburg, Miss., is also capable of use as a rake or cultivator, and is designed to be quickly and conveniently manipulated. It has a main outer frame and an inner suspended frame, a series of hangers from the front cross bar of the latter having slots which receive a bar extending from side to side of the main frame, this bar being raised and lowered by upright rods, threaded at their ends, on which is a nut with handle attached. At each rear corner of the main frame is a standard carrying a segmental grooved pulley, a standard on each forward end of the frame supporting a shaft carrying segmental grooved pulleys in alignment with those at the rear, while a chain secured to the front end of each segmental pulley forward is extended by a link to connection with the forward side of the rear segmental pulleys. The forward cross bar of the inner frame is hinged to the adjustable bar of the main frame, and the inner frame is also attached to the outer by a length of chain at each rear corner, the chains being carried up over the segmental pulleys to attachment at a point near where these links are attached to the pulleys, the inner frame being raised and lowered by a lever through these link and chain connections. Upon the inner frame are transverse shafts supporting the teeth, formed in the shape of a sickle, any one or more of the teeth being readily removable as desired, while the forward teeth have beveled side faces to throw the dirt to the right and left. The rear teeth are so placed that their convex edges will face to the front, and this edge is sharpened or brought to a knife edge, that the teeth may act as pulverizers, the shaft to which these teeth are attached being held in position by springs, to permit the teeth to pass over obstructions. Levers upon the forward transverse shaft of the inner frame are so connected by means of links as to enable the operator to give the desired inclination to the two forward series of teeth, these levers being adapted for latch engagements with racks. The implement may be used as a cultivator by removing two of the middle teeth from their spindles and raising the rear set of pulverizer teeth. As a harrow the teeth are intended to enter the soil about twelve inches, and when the implement is used as a rake, the rear set of teeth is also preferably removed.

FLANAGAN'S HARROW AND CUTTER.

Making the Deserts to Bloom.

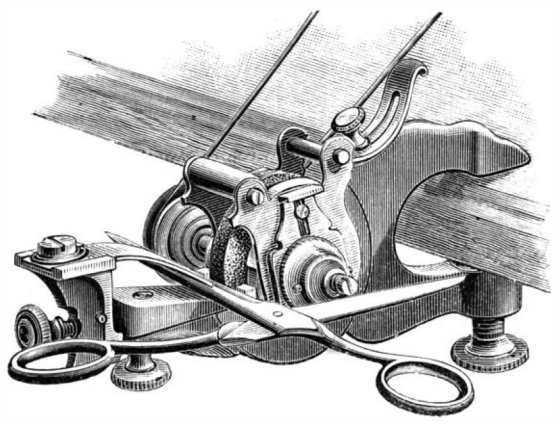
Professor Hilgard, Director of the Agricultural Experiment Station at Berkeley, and esteemed the best authority in America on these matters, says the underflow of great gravel beds existing in the southern part of California is proving to be of increasing importance as a source of irrigation supply. It is possible to maintain and increase the supply of water far beyond its present magnitude. All that is necessary is to understand the controlling principle of its action. These gravel beds are natural storage reservoirs. They may be emptied and replenished, with due regard to the rainfall and drainage. Antelope Valley, in San Bernardino and Los Angeles Counties, a high intermountain plain or basin stretching between the Mojave Desert and the upper part of the great Colorado Desert, has been considered, until recently, almost irreclaimable. There are now upon it several great fruit colonies.

In reply to inquiries for information sent out there by the department, interesting answers have just come. They give the details of three large surface systems of irrigation by water drawn from mountain streams. This has all been done since April, 1889. There are fifty miles of main ditches, five feet wide at the top, and fifty miles of smaller ditches, two and a half feet wide at the top. There are three reservoirs with a capacity of 30,000,000 gallons. There are five dams, five headways, seven weirs, and six mountain tunnels. The expenditures to date amount to $450,000. To this will be added $21,000.

The land now irrigated amounts to 10,000 acres, and will be increased to 25,000 acres. Small grains, cotton, and alfalfa are the chief crops. Such experiments as have been made with fruits have given great results. The land is chiefly government, unpatented, and, therefore, unassessed for taxation. Patented land, irrigated, sells for from $10 to $50 an acre. Non-irrigated land is worth from $2.50 to $8 an acre. Five artesian wells have been sunk in a belt of twelve miles. They indicate that a much greater supply of water is available. These wells are from 180 to 500 feet deep. They have a flow of from 50,000 to 200,000 gallons in twenty-four hours. They serve about 7,000 acres. There are 100 dug and bored wells, with wind or steam power, ranging from 20 to 100 feet deep. These wells penetrate the gravel drift, and supply water for vegetable and stock purposes, and for desert and tree claims. This is the beginning of what is believed will result in the reclamation of the whole valley, and even of the Mojave Desert.—*Pacific Lumberman.*

AN IMPROVED SCISSORS GRINDER.

The device shown in the illustration is adapted for attachment to a sewing machine table or other support, and is so constructed that the edges of scissors blades may thereby be hollow-ground when desired, without grinding the cutting edges, the separate grinding of the latter being also provided for. It is a patented invention of Mr. Frederick Visscher. The shaft carrying the emery wheel passes through two hubs, on each of which is an eccentric collar on which is fitted the lower end of an upwardly extending plate having a vertical slot, and a circular flange integral with its upper edge. A second inner plate is attached to the outer plate by a set screw, but has a slot by which it is capable of free vertical movement, and when the outer plate is rocked upon its eccentric collar the inner plate is carried upward thereby, there being plates on each side of the body, and the inner plates also having horizontal flanges at the top to correspond with the flanges on the outer plates. From the upper edge at each corner is an upwardly extending arm, and the arms of the plates at each side of the body are connected by rods or bolts, so that the connected plates constitute a carriage to receive the blade of the scissors to be hollow-ground. When the carriage is carried in the direction of the clamp, the blade is transversely presented to the grinding wheel, but by reason of the eccentric mounting of the carriage the cutting edge is kept out of contact with the wheel. The carriage is locked in the desired position for proper grinding by a slotted curved latch which extends from the carriage, a binding screw passing through the slot of the latch. When the cutting edge of the blade is to be ground, it is placed on a tapering block held to slide on the body, as shown in the illustration. The block is adjustable to and from the wheel by means of a set screw, while it is retained in adjustment by a binding screw, and the blade is held in proper position upon the block by means of a spring, the lower end of which has a bearing upon the upper face of the blade.



VISSCHER'S AUTOMATIC SCISSORS GRINDER.

For further information relative to this invention address the patentee, or Mr. Frederick F. Visscher, No. 5½ Dexter Avenue, Montgomery, Ala.

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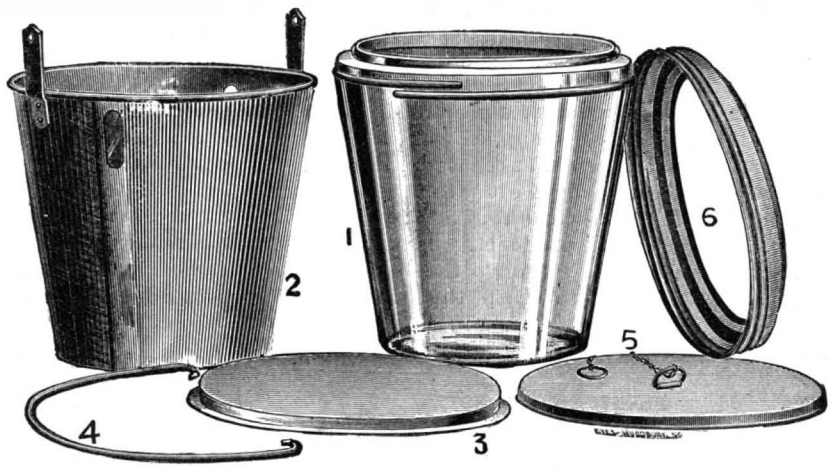
THE WORCESTER CHEMICAL FIRE PAIL.

The fire pail shown in the accompanying illustration forms the subject of several patents which have been taken out in the United States and foreign countries, and has received the strong indorsement of leading insurance men, and of prominent manufacturers and mill owners who have given it a trial. The pail proper is made of glass, consequently it cannot rust out, soak out, or dry up and fall to pieces, as so frequently happens with other pails. It has a threaded top as shown in Fig. 1. The glass interior is inclosed in a corrugated tin jacket, Fig. 2, which protects the glass and has openings in its sides at the top so that the liquid contents may be readily inspected. After being filled with a chemical fire-extinguishing liquid, the glass pail is hermetically sealed with a soft tin foil cover, Fig. 3, which is secured in place by having screwed over it a rim, shown in Fig. 6. The bail, shown in Fig. 4, is so made as to hold the pail and tin jacket together; and the tin cover, which fits over the tin foil top, is connected by a small chain with an eye on the hook by which the pail is ordinarily suspended ready for use, as shown in one of the views, so that when the pail is quickly taken for use, in any emergency, the cover will be automatically removed. The tin foil cover is then readily broken with a slight thrust of the hand, and the liquid, which has been kept from evaporation, is ready for use. This chemical liquid is said to contain no acid, will not freeze, and will not harm the hands or clothing, and will not lose its strength by being kept for a long period. Coming in contact with flame, it is designed to evolve 1,500 times its volume of fire-extinguishing vapor, and also form a fireproof coating, making it impossible for the fire to continue where it strikes.

Further information relative to these handy fire buckets may be obtained of the manufacturers, the Worcester Fire Appliance Company, Worcester, Mass.

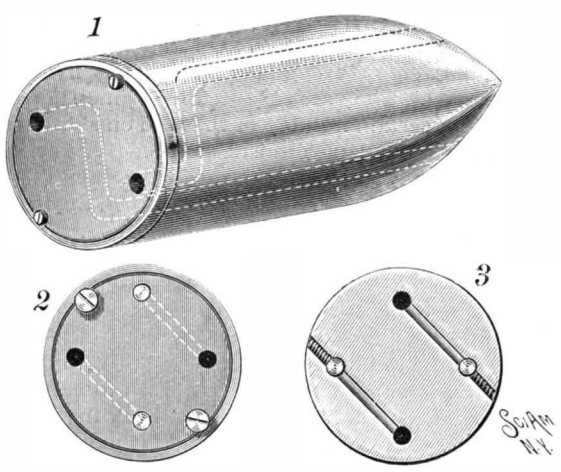
THE WORCESTER CHEMICAL FIRE PAIL COMPLETE.



DIFFERENT PARTS OF THE WORCESTER CHEMICAL FIRE PAIL.

A PROJECTILE ROTATED BY THE EXPLOSIVE.

In the projectile shown in the illustration, which has been patented by Mr. William Bowman, of Atchison, Kansas, it is designed that a portion of the gases generated by the explosion shall pass through transverse and horizontal passages of the projectile, and, bearing upon the walls of the passages, act to turn the projectile, on the principle of the Barker mill. Fig. 1 is a perspective view, showing in dotted lines the passages through the projectile, Fig. 2 representing the butt end of the projectile, in the edges of which is the usual gas check, held in place by set screws. Two or more bores are made from the forward end of the projectile to a point not far removed from its base, where they are intersected by smaller transverse bores, tangential to an imaginary circle concentric with the peripheral face of the projectile, the other end of the smaller bores opening into bores extending forward from the butt of the projectile. The transverse bores may be made, as shown in the cross sectional view, Fig. 3, by boring in from the outside of the projectile, and afterward inserting plugs to close the exit of the gases except through the longitudinal passages, or such transverse bores may be made diagonally from openings in the base, thus avoiding the use of plugs. The necessity of rifling or grooving gun barrels is designed to be obviated by the use of this projectile, to which the necessary rotary motion may be given by the force of the gases of explosion acting on the walls of the passages.



BOWMAN'S PROJECTILE.

The Preservation of Timber.

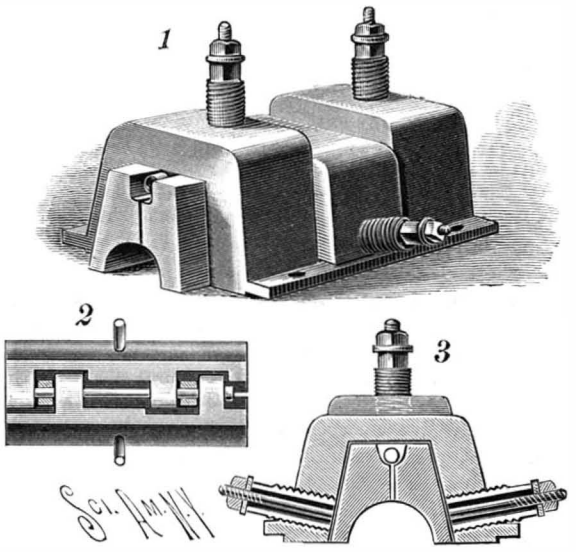
The chief processes that have been employed for the preservation of timber are, says *Engineering*, kyanizing, burnettizing, and creosoting, that is, impregnation with bichloride of mercury, with sulphate of zinc, and with creosote. Many others have been proposed and tried, but only these three have survived. The first seems to be well adapted for bridges, or for timber exposed to weather alone, and not to constant moisture. Examples have been found in America which were in a good state of preservation after twenty-eight years' exposure. But when kyanized timber has been used for railway sleepers and pavements it has had only a doubtful success, probably in consequence of the washing out of the corrosive sublimate. The wood is allowed to steep one day for each inch in thickness of its least dimension, and one or two days in addition. The solution contains 1 per cent by weight of corrosive sublimate, and from 4 lb. to 5 lb. of this are absorbed per 1,000 ft. b. m. Burnettizing may be performed in the same way, sulphate of zinc being the chemical employed, but it is usual to steam the timber first to open the pores, and then to subject it to a vacuum to withdraw the sap. If this be not done, the timber must be stored for a considerable time to allow it to dry naturally. When treated the wood should not be placed in exposed situations, such as bridges, or else the zinc will be washed out and leave it unprotected. This is particularly true when weak solutions are used, and when the potency is greatly increased the tenacity of the timber is impaired. In Germany 1·91 per cent is considered the proper strength for railway sleepers. Several suggestions have been made to confine the zinc in the timber; Mr. W. Thelmany proposed to subject the timber to a subsequent bath of chloride of barium, with the view of producing an insoluble sulphate of baryta. It is doubtful, however, if the reaction would go on in the minute sap ducts of the wood. Another process is that of Mr. Wellhouse, who also employs a double solution, the first being chloride of zinc to which a little glue is added, and the second a solution of tannin. It is claimed that the latter upon coming in contact with the glue forms small particles or films of artificial leather which plug up the mouth of the sap ducts and prevent the zinc being washed out. Certain experiments which have been made seem to confirm the idea. Another plan consists in using a solution of chloride of zinc and gypsum. The gypsum crystallizes and hardens inside the sap ducts, and forms partitions to hold the zinc within the cells. There are three burnettizing works in the States, and the cost of the process is about $5 per 1,000 ft., board measure, or 20 cents to 25 cents a sleeper.

Creosoting is so well understood that it scarcely needs description. It is in almost universal use for sleepers for English railways, and no other process has been commercially proved capable of resisting the *Teredo navalis* and *Limnoria tenebrans*. Here and in Holland 10 lb. to 12 lb. of creosote oil per cubic foot of timber are found sufficient for harbor purposes; the French use 19 lb. for the same purpose, and a similar quantity has been found necessary in the Gulf of Mexico, where the marine worms cut off an unprepared pile in eight months. The creosoting process needs to be well done to be effective, and for ordinary purposes 8 lb. to 12 lb. are required per cubic foot of timber.

It was generally considered that the presence of heavy oils in the creosote was objectionable, and therefore engineers were accustomed to specify that not more than 10 per cent should be present. This view has been controverted by others, who take the view that it is only the heavy oil which can be relied upon to exert a continuous preservative action, the creosote itself being liable to become dissipated in course of time. This view receives confirmation by the good results of the preservative process introduced by Mr. Henry Aitken, of Falkirk. This consists simply in soaking timber in melted naphthaline for a period varying from two to twelve hours, depending on the bulk of the piece. A temperature of 180° to 200° Fahr. is all that is required for the process, and is most easily obtained by placing steam pipes in the bottom of the tank which contains the material. Simple as the process is, that is not its chief merit. A more valuable feature is that it can be applied to green timber, thus doing away with the long and expensive process of seasoning. The naphthaline makes its way through the pores of the wood, decomposing the albuminoid compounds, and displacing both sap and water. It then becomes fixed, and the whole substance is permeated with solid antiseptic of a permanent character.

A JOURNAL CAP FOR WOOD-WORKING MACHINES.

The illustration represents a journal cap more especially designed for use on bearings of spindles which carry matcher heads on planers, and also adapted for other machines, being capable of ready and accurate adjustment to take up wear. It is a patented invention of Mr. Willard A. Shank, Amoskeag, Ga. On the inside of the casing is a longitudinal recess in which are held two bearing plates or boxes, as shown in the perspective view, Fig. 1, and the sectional view, Fig. 3, these plates together forming a semicircular recess to engage the top of the spindle. The plates are connected with each other on top by a hinge, as shown in Fig. 2, the pintle of the hinge being passed through eyes in the lower ends of screw bolts which extend upward through hollow screws screwing in the top of the casing. Nuts on the outer threaded ends of the bolts screw against washers on the outer ends of the hollow screws, and by screwing the latter up or down in the casing the pintle of the hinge is raised or lowered to move the bearing plates up or down in the recess. An arm extends outwardly from the side of each bearing plate through a hollow screw adapted to abut against the plate, a nut screwing on the outer end of the arm against a washer bearing on the hollow screw, whereby the bearing may be firmly held in place by screwing up the nut. When the cap is first used, the bearing plates are left slightly apart, as shown in Fig. 1, the screws being afterward adjusted to move the plates downward and inward when their inner recessed surfaces have become slightly worn, whereby all slack or wear is taken up.



SHANK'S JOURNAL CAP.

Phenomena by Means of the Electric Discharge.

In a recent communication to the Academie des Sciences, M. Ch. V. Zenger states that observations of the effects produced by the Wimshurst machine on smoked glass plates led him to experiment with a view of obtaining an electrically produced imitation of various well known solar phenomena. A large sheet of glass well dried on one face and covered with lampblack on the other was placed between the terminals of a Wimshurst machine. The + pole was brought very close to the blackened surface, in the center of which there was a circular tin disk. The — pole was from 10 to 20 cm. distant from the other side. Sparkless discharges disturbed the blackened surface, and a representation of the lines of electric force was drawn upon the glass. The result was a striking reproduction of a total eclipse of the sun, the metallic disk representing the moon. The lines of force produce around the edge of this disk all the chromospheric phenomena witnessed during a solar eclipse, such as eruptive, linguiform and auroral protuberances. If the experiment is carried out in a dark room, red flames may be seen coming from the edge of the disk, which exactly resemble in form and color those visible during a solar eclipse. Blackened glass balls submitted to the Wimshurst discharge exhibit white spots, the photographic negatives of which are precisely similar to those of sun spots.

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Correspondence.

The Machinist's Shibboleth.

To the Editor of the Scientific American:

To form an estimate of a machinist's ability, in these days of improved methods, is not so easy a matter as it was thirty years ago. Almost everything is now done on machine tools, and the hammer, chisel, and file are little used. In the old time, it was by his manner of using these that we were accustomed to gauge the skill possessed by the new man. If he took hold of his hammer handle at the middle, and struck as if his elbow had no joint, or took up a file with his thumb under the handle and shoved it across the work with a teetering, jerky motion, he would at once be put down as an impostor.

Sometimes worse blunders than these were committed. For instance, grinding the cutting edge of a drill on the wrong side, or attempting to put a belt on a pulley from the wrong side.

The file test is a good one, and, if followed up, may put to shame some who claim to be good workmen. We wonder if one in ten of the thousands of machinists who read your paper can file a spot on a round iron bar, perfectly straight, crosswise. We have seen such a surface concaved by the slight rotundity of the file. One of the interesting features of this performance is the nice vibratory movements of the joints in the arms and body that are necessary to secure the perfectly parallel motion of the file. Comparing these with the mechanism in the beam engine, the latter is very simple, for in this there is but one point to be kept in a parallel line (the crosshead), while with the file both ends must be controlled and held true to a line. Yet the operation seems very easy when, by practice, the the art is acquired.

The plumber takes pride in his "wiped joint;" the slater in shearing and punching his brittle material, like so much putty; the blacksmith his perfect weld; and the machinist will ever esteem his dexterous use of the file as one of his best proofs of skill.

One of the modern tests, we believe, is the use of the scraper; and the fitting together of two surface plates so perfectly that they can only be separated by sliding them apart, may be considered no mean art.

QUIRK.

The Curability of Galloping Consumption.

The announcement by so well known a physician as Dr. McCall Anderson that acute phthisis, or galloping consumption, is curable, excites a good deal of surprise and quite as much incredulity, yet Dr. Anderson reports in the *British Medical Journal* seven cases of this character, of which five recovered.

Acute phthisis is considered by Dr. Anderson to have two forms, acute tuberculosis and acute pneumonic phthisis. Some of his cured cases were of the tubercular character. The treatment advised is given in detail and contains no especially new feature.

"The principal indications," he says, "are: 1, to keep up the strength; 2, to keep down the fever; and 3, to treat any special symptom or complication which may arise.

"1. Two thoroughly trained and reliable nurses are indispensable, one for day and the other for night duty; for without admirable nursing no hope of improvement can be entertained; and the hygienic and other surroundings of the patient should be satisfactory, so that we need not be surprised that when the disease occurs in the homes of the working classes it is almost necessarily fatal, and that hospital patients have the best chance of recovery. The patient must be fed constantly on fluid food (soup being avoided if diarrhea is present), both day and night, and stimulants (from ℥ ij. to ℥ x.) are required early in the attack, but should be given in small quantites, frequently repeated and along with the food. In fact, the dietetic treatment should correspond with that of a case of fever presenting symptoms of a similar degree of severity.

"2. At bedtime a subcutaneous injection of sulphate of atropine (gr. $\frac{1}{100}$ to gr. $\frac{1}{60}$) is given. This checks perspiration when present, acts as a sedative to the system, indirectly helps to reduce the fever, and diminishes the secretion from the lungs.

"3. Remedies are given with the view of lowering the temperature. This is a point of the utmost consequence, because the majority of the patients die consumed by the fever. Some benefit is derived by allowing the sufferer to suck ice freely, by giving the food and drinks iced, by sponging the body with iced vinegar and water, or even by using iced enemata. But our main reliance is upon one or more of the following methods:

"(*a*) Niemeyer's antipyretic pill or powder every four hours, containing gr. j. quinine, gr. ½ to gr. j. digitalis, and gr. ¼ to gr. ½ opium. The portion of opium may even have to be increased beyond this if there is much diarrhea. The effect of the digitalis must be carefully watched, and it must be omitted for a time if the pulse becomes preternaturally slow and irregular and the secretion of urine very scanty.

"(*b*) The administration daily—particularly shortly before the temperature tends to be highest—of from ten to thirty grains of quinine, given, as suggested by Liebermeister, either in a single dose or, at all events, within an hour.

"(*c*) The application of iced cloths to the abdomen for half an hour every two hours so long as the temperature exceeds 100°. The application of iced cloths is made in this way:

"The nightdress is pulled well up over the chest, so as to avoid any possibility of its being wet, and, for a similar reason, a folded blanket is placed across the bed under the patient's body. The usual bedclothes are arranged so they reach up to the lower part of the chest only, which latter is covered by a separate blanket in order to prevent unnecessary exposure while the cloths are being changed. Two pieces of flannel are employed, each being sufficienly large when folded into four layers to cover the whole of the front and sides of the abdomen. One of these, wrung out of iced water and covered with a piece of dry flannel to protect the bedclothes, is applied, while the other is lying in a tub of iced water at the side of the bed. The pieces of flannel are changed every minute, or so often that they still feel cold when they are removed. The changing of the flannel, particularly when two persons are in attendance, one to remove the bedclothes and the flannel, the other to apply the piece which is freshly iced, can be accomplished in a few seconds."—*Medical Record.*

PHOTOGRAPHIC NOTES.

The American Photographic Conference is the title of a new organization of scientific and amateur photographers recently organized in New York for the purpose of establishing an association which shall be national in character and have as its controlling element representatives of all the photographic societies and clubs in the United States or of America.

An annual conference is to be held in different cities, to last three days and be accompanied by an exhibit of photographs and apparatus. Papers and researches on different branches of photography are to be read and measures adopted for furthering the practice of photography. One of the objects of the conference will be the establishing of a photographic institute, where, for a given tuition, any special application or branch of photography can be learned. The next meeting is to be held April 21, 1891, in this city. Among the officers elected were: President, Dr. Ely Van de Warker, of Syracuse, N. Y.; Secretary, T. J. Burton, of the Society of Amateur Photographers, of New York.

The transactions of the conference are to be published and distributed to members. Any amateur or professional photographer may join the conference as a subscribing member, the annual fee being but three dollars.

How to Remove Nitrate of Silver Stains from the Fingers.—A correspondent gives the following harmless process:

First.—Paint the blackened parts with tincture of iodine, let remain until the black becomes white. The skin will then be red, but by applying ammonia the iodine will be bleached, leaving white instead of black stains of nitrate of silver.

Density in Negatives Developed with Eikonogen.—A correspondent having some trouble with eikonogen writes as follows:

Mr. Burbank in his excellent handbook on "Development of Dry Plates," mentions the fact that instantaneous views lose their density in the fixing bath. I find this trouble myself, and that my well developed plates are but ghosts of what they were before being placed in fixing bath.

Mr. Burbank makes no suggestion as to the remedy; can any of your readers give any advice in the matter?

I notice in another part of the book Mr. Burbank speaks of certain brands of plates having this trouble, but mentions no name. Is this the only cause?

Our correspondent signs himself Eiko, which we suppose means that he employs the Eiko developer. In general it may be remarked that the amount of density an instantaneously exposed plate is capable of giving depends on the actinic quality of the light at the time of the exposure and the duration of development. The stronger the light and the slower the shutter, the more deeply will the light penetrate into the film and affect a greater number of the particles of bromide of silver, which, being reduced by the developer, gives the relative density. Hence it follows that a film which has only been faintly impressed with light, as some of the instantaneous exposures are, cannot be brought out by the most powerful developer any further than the action made upon it by the light. That is, the particles of silver on the surface are reduced first and the picture appears on the surface fully developed and of sufficient density we will suppose .by reflected light. But the light not having had time to pass through the film has not acted on the underlying stratum, thus the stratum is unaffected by the developer. When the supposed fully developed plate is now put into the fixing bath, the underlying stratum of bromide of silver is dissolved out, which necessarily reduces the density very much and gives the negative the appearance like that described.

There is no remedy for this, except, should the detail appear fully developed, to resort to intensification, or the building up of the image obtained. The precautions to be observed are to use a strong eikonogen developer, 11 grains of eikonogen to the ounce of water and 10 grains to the ounce of carbonate of potash, pouring the eikonogen solution, without the addition of potash, on to the plate for four minutes first, then by adding the potash. Development should be kept up until the high lights show through at the back of the plate and until the density looks sufficient by transmitted ruby light, though when this time arrives the plate may appear to be black over its entire surface.

The general fault is that insufficient time is allowed for the bringing out of the image. The eikonogen developer may be left on a plate for two hours without staining the parts that were in the shadow; thus it is admirably adapted for shortly exposed plates. It is true also as Mr. Burbank remarks that some brands of plates have too little silver for instantaneous work; such can only be found out by experiment. When an emulsion is found to work well, it is advisable to secure more plates of the same number, if uniformity and certainty are desired. In cold weather the temperature of the developer should be at 65° F.

Stokers on the Fast Ships.

On the steamship City of Paris there are sixty firemen, who feed the fiery maws of fifty-four furnaces, that create steam in nine steel boilers. Fifty coal passers shovel the fuel from the bunkers to the furnace doors, and the firemen toss it in. There is something more than mere shoveling in firing. The stoker must know how to put the coals on so they will not burn too quickly or deaden the fire. He must know how to stir or poke the fire so as to get all, or nearly all, the caloric out of the coal. He must know how to obtain the best results from the Welsh coal he burns on the voyage to this port and the American coal he uses on the trip eastward. Each kind requires different handling. Often the result of a race eastward has been determined by the superior knowledge of the handling of American coal possessed by the winning ship's stokers. To a man who thoroughly understands it, firing is easier than it used to be. But it is, nevertheless, so arduous that the veterans are not over forty-five years old. Nearly all the stokers on the City of Paris and the City of New York are between twenty and thirty years of age. They received $20 a month and their board. The leading stoker gets a few dollars more, and does not have to work quite so hard. He is usually the eldest of the crew he directs. The coal passer, the limit of whose ambition is to become a fireman, gets $17.50 a month. The leading coal passer, or trimmer, gets a little more than this.

Service in the fireroom is divided into six watches of four hours each. The fireman works and sleeps every alternate four hours. After the first day from port two out of every six furnaces are raked out to the bare bars during the first hour of each watch. Thus, in a voyage, all the furnaces are cleaned once in every twenty-four hours. The steam goes down a bit in the hour while the cleaning is going on. The perspiring stokers shovel into the furnaces fifteen tons of coal every hour, or 340 tons a day. The ship usually takes in 3,000 tons at Liverpool, and has between 500 and 800 tons left in her bunkers when she arrives here.

The engineers' department is entirely distinct and separate from the fireman's. On the City of Paris there are twenty-six engineers, including hydraulic and electrical. They are educated in engine shops on shore, and a certain number of them go on ships every year. They are all machinists, so whenever the ship break down they know how to repair the damage. In case the chief engineer should be disabled, any assistant could take his place.—*New York Sun.*

Laziness a Foe to Originality.

We do not know who said it, but it is a fact well stated, and we regret not being able to give the writer proper credit. The great enemy to individualism is laziness, and those who know anything of human frailties will, I am sure, bear me out when I say that "mental" laziness is far more common and far more difficult to overcome than that of the body. It is so much easier to accept dogmatic teaching, and to shift the responsibility of our views on to others rather than to concentrate our thoughts and work out the lessons of our own observations. It is much more pleasant to butterfly from theory to theory than to seek truth with patient tenacity; why trouble ourselves to learn self-reliance, when natural indolence protests against the sacrifice?

It is easier to imitate than to originate; plagiarism and mimicry are such prominent features in our lives, that their presence might almost be quoted as an argument in favor of our evolution in past ages from simian ancestry. How plausible are the excuses we make for our want of this individualism! We are so dreadfully afraid of being thought bumptious, we are so delightfully humble, we really do not wish to intrude our opinion, and yet all the brightest lights of our profession have been men of strong individualism.

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The Railroad across South America.

El Echo de los Andes, a semi-technical newspaper, in its issue of August 28, gives the latest particulars concerning the Transandine Railroad. Attention is especially called now to the cutting of the tunnels which, under the snowclad mountain, will unite Chili and the Argentine Republic. The total length of the tunnels already cut is 1,800 meters (the meter being equal to 39·38 English inches); 750 meters on the Chilian side and 1,050 on the Argentine side.

The international railroad of the Andes, as is well known, is being built jointly by Chili and the Argentine Republic, the two countries which it will unite directly, and each of which is working on its own territory. The frontier limit of the two nations is in the tunnel of la Cumbre, or "the Summit." The Buenos Ayres government began its tunnel work three months before Chili, which explains the fact that out of the 1,800 meters of pierced tunnel only 750 belong to Chili. But this difference will not be maintained, for Chili is now working more rapidly. For instance, 180 meters have been recently perforated on the Chilian side, while only 160 were cut on the Argentine side within about the same length of time.

The monthly progress in perforating amounts to about 450 meters. There is a succession of eight tunnels, crossing from one side of the Andes to the other. The tunnels, with their lengths, are as follows:

Tunnel.	Length in meters.
Juncal	1,104
Juncalillo	1,275
Portillo	1,885
La Calavera	3,750
La Cumbre	3,065
Las Cuevas	850
Navarro	756
Las Lenas	690
Total length	15,375

Of these tunnels, 11,158 meters are on the Chilian territory and 4,217 on Argentine. The work is, therefore, of greater importance to Chili than to the Argentine, not only on account of the large number of miles to be tunneled, but also because the engineering difficulties are greater. For instance, the tunnel of Del Portillo is really a curiosity. It is helicoidal in form, and is like an immense corkscrew, winding under the mountain. Its upper opening is 135 meters above its lower entrance. The tunnels are divided into three sections, two belonging to Chili and one to the Argentine Republic. The section of Juncal includes the two tunnels of Juncal and Juncalillo; and that of Calavera includes the tunnels of Portillo, Calavera, and Cumbre. All these are on the Chilian side, while the section of Las Cuevas is on the Argentine side.

In each of those sections are erected houses for engineers and workmen, hospitals, office buildings, etc. They are built of materials capable of resisting the intense cold of those high regions.

The tunnels are attacked in twenty-six different places; half on the Argentine and half on the Chilian side. The finest machinery and engines are used, and motive power is mainly furnished by electrical machines, working on a larger scale than has ever been attempted before in similar undertakings. It is calculated that, through the use of that kind of motive power, and of improved machinery, the work moves four or five times as rapidly as if it were done by the ordinary methods.

African Earthworms.

The last *Kew Bulletin* contains a report by Mr. Alvan Millson, the Assistant Colonial Secretary of Lagos, on Yoruba Land, the native territory adjacent to Lagos. After describing the wasteful system of cultivation employed by the natives and the wonderful rapidity with which the soil recovers from it, he says the mystery is solved in a simple and unexpected manner during the dry season. The whole surface of the ground beneath the grass is seen to be covered by rows of cylindrical worm casts. These vary in height from a quarter of an inch to three inches, and exist in astonishing numbers. It is in many places impossible to press a finger upon the ground without touching one. For scores of square miles they cover the surface of the soil, closely packed, upright, and burnt by the sun into rigid rolls of hardened clay. The rains ultimately break them down into a fine powder, rich in plant food and lending itself easily to the hoe of the farmer. These casts are very different in form from those familiar in English gardens. On digging down, the soil is found to be drilled in all directions by a countless multitude of worm drills, while from 13 inches to 2 feet in depth the worms are found in great numbers in the moist subsoil. It is impossible to estimate their number per cubic foot, as the quantity varies according to the season and the locality. Having carefully removed the worm casts of one season from two separate square feet of land at a considerable distance from one another, and chosen at random, Mr. Millson found the weight to be 10¾ pounds in a thoroughly dry state. This gives a mean of over 5 pounds per square foot, and a total of not less than 62,233 tons of subsoil brought to the surface on each square mile of cultivable land in the Yoruba country every year. This work goes on unceasingly year after year, and to the untiring labors of its earthworms this part of West Africa owes the livelihood of its people. Where the worms do not work, the Yoruba knows that it is useless to make his farm.

Estimating 1 square yard of dry earth by 2 feet deep as weighing half a ton, there is an annual movement of earth per square yard of the depth of 2 feet amounting to not less than 45 pounds. From this it appears that every particle of earth in each ton of soil to the depth of 2 feet is brought to the surface once in twenty-seven years. If seems more than probable that the comparative freedom of this part of West Africa from dangerous malarial fevers is due, in part at least, to the work of earthworms in ventilating and constantly bringing to the surface the soil in which the malarial germs live and breed. From specimens which Mr. Millson has sent home it appears the worm belongs to a new species of the genus *Siphonogaster*. The type of this genus has been quite lately described from the Nile mud.

BACILLUS OF TUBERCULOSIS.

It is well known that infectious diseases, such as consumption and cholera, have a parasitic origin, and that each one of them has its characteristic micro-organism. In 1878 Dr. Koch published his "Untersuchung ueber die Aetiologie der Wundinfectionskrankheiten," which embodied the results of his investigations in this field of research and formed the basis of future study, the result of which was the discovery of the bacillus of tuberculosis. The course followed by Dr. Koch has been so fully explained in former issues of the SCIENTIFIC AMERICAN that it seems unnecessary to treat the subject again in detail, but we publish to-day two excellent cuts, for which we are indebted to the *Illustrirte Zeitung*, showing the bacilli alone and as they are found in the tubercles.

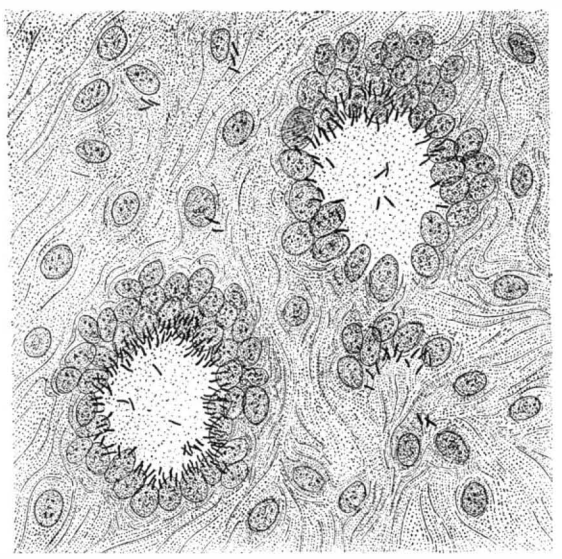

Fig. 1.—SECTION THROUGH TUBERCLES OF THE LUNGS, SHOWING TWO LARGE CELLS WITH NUMEROUS BACILLI.

The specimen having been colored, the bacilli appear as dark dashes. Magnified 900 times.

Dr Koch's methods, which have been so strikingly confirmed by his work, have opened new fields in the science of bacteriology, and the results of his work have been felt in every department of medicine.

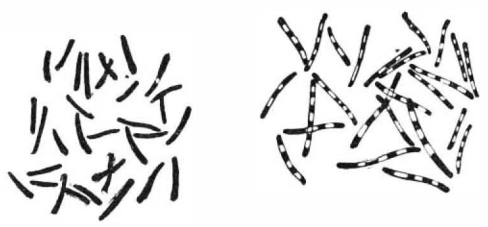

Fig. 2.—TUBERCULAR BACILLI, MAGNIFIED 2,000 TIMES.

At the left, bacilli free from spores. At the right, bacilli with colorless places which are supposed to be spores.

Photo Carbon Printing.

BY T. C. ROCHE.

The principle or foundation of carbon printing is based on the action of light on bichromate salts when combined with organic matter. This discovery was first brought to public notice by Mungo Pontou in 1839. M. Becquerel, Mr. Fox Talbot, and others experimented on this new reaction, but M. Poitevin, in 1855, was about the first to bring out any real practical results. It was through him that photo-lithography, photo-mechanical printing and kindred processes were put into commercial use.

The first to introduce prepared carbon tissue, and a practical formula for working the same, was Mr. J. W. Swan, in 1864. Since then there have been several important improvements made, simplifying the process still more. A suitable paper is coated in long rolls with a pigmented gelatine; this is cut to the required size and sensitized for use in a bath of bichromate of potash, 15 to 20 grains per ounce of water. When dried in a dark room it is ready for exposure, under the negative, to the action of sunlight. It is important that the negative has a safety edge about half an inch all around it, to prevent the light from acting on the margin of the tissue. After exposure, which must be judged by a photometer, the tissue is placed in cold water until it lies limp and flat. Your glass or porcelain, which has been cleaned and coated with plain collodion, is wetted or washed in water, then laid on a table, some water sprinkled on, the carbon paper is laid face down on it, a thin rubber cloth laid over, and then a squeegee passed over lightly to bring the carbon paper in contact and drive out all air bells. It is now allowed to rest for a few minutes, then placed in a pan of tepid water and rocked. The first portion of the gelatine mixture to dissolve is that which had been protected by the safety edge on the negative. Now the paper which had been coated can be peeled off and the transferred picture washed out according to the gradation or tones in the negative and the action of light on the sensitive compound. The coating is rendered more or less insoluble, and all soluble portions will wash out in the warm water. The picture is then washed in cold water, and finally a solution of alum water is flowed over and the plate set up to dry. While the surface is wet it is very tender, but will dry hard and sharp.

The collodion is used to prevent the delicate detail or half tone from washing away. In sensitizing or washing, the light has no effect on the material while wet. After sensitizing, the paper will keep two weeks if put in an air-tight tin box. Porcelain or zinc plates that have been cleaned, slightly waxed, and then collodionized, can have the proofs developed on them re-transferred when dry on to transfer paper by wetting the paper until it feels slimy, then squeegeeing it down on the picture, and when dry it can be peeled off easily. Proofs on porcelain or for lantern slides should be printed light; those for window transparencies, deeper. The proofs can be, after printing, transferred to almost any material, such as celluloid, metals, or wood. When you hang the paper up to dry after sensitizing, it must be in a room well ventilated; if not, the coating is apt to dry insoluble and will be of no use. All carbon pictures are considered permanent.—*Jour. Soc. Am. Photo.*

Completion of the Great Mountain Bridge.

The new Verrugas bridge was lately opened for traffic. The bridge is of the cantilever type, supported on two iron towers. Its total length is 575 feet, its suspended span being 105 feet long. At its middle point it is 252 feet above the bottom of the valley which it spans. The bridge is entirely of wrought iron, and was constructed by Cooper, Hewitt & Co. at their works in Trenton.

The Verrugas bridge is one of the features of the Oroya Railway, now known as the Central Railway of Peru. This railroad starts from Callao on the Pacific, runs through Lima, and thence ascends the Andes by difficult grades, reaching its greatest elevation at Chicla, about 12,300 feet above the level of the sea. The bridge spans a chasm of 235 feet in width, with precipitous sides, and replaces the old Verrugas viaduct built in 1871, which was destroyed in March, 1889, by floods.

The Harvester Trust.

A mammoth combination has been effected between the harvester machine companies of the United States. The new trust is to bear the name of the American Harvester Co., and it has been organized under the laws of the State of Illinois, with a capitalization of $35,000,000. The following companies have acknowledged their allegiance to the new company: The McCormick Harvesting Machine Company, Chicago; the Walter A. Wood Mower and Reaper Machine Company, Hoosick Falls, N. Y.; Warder, Bushnell & Glessner, Springfield, O.; Aultman, Miller & Co, Akron, O.; the Whitman & Barnes Manufacturing Company, Akron, O.; the Plano Manufacturing Company, Plano, Ill.; the Milwaukee Harvester Company, Milwaukee, Wis.; the Esterly Harvesting Machine Company, Whitewater, Wis.; the Minneapolis Harvester Works, Minneapolis, Minn.; Emerson, Talcott & Co., Rockford, Ill.; the J. F. Seiberling Company, Akron, O.; Seiberling, Miller & Co., Doylestown, O.; Amos Whitley & Co., Springfield, O.; Hoover & Gamble, Miamisburg, O.; D. M. Osborne, Auburn, N. Y.; the Richardson Manufacturing Company, Worcester, Mass.; Adriance, Platt & Co., Poughkeepsie, N. Y.; D. S. Morgan & Co., Brockport, N. Y.; the Johnston Harvester Company, Batavia, N. Y.

The incorporators are Cyrus H. McCormick, Wm. Deering, Hon. Walter A. Wood, Hon. Lewis Miller, Gen. A. N. Bushnell, and Col. A. L. Conger.

Some idea of the interests that will be affected by the trust may be inferred from the fact that nearly all the farmers will be affected favorably or unfavorably by the trust, and it is stated that the companies included in the corporation employ some 15,000 men.

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METALLO CHROMES.

BY GEO. M. HOPKINS.

The production of Nobili's rings is a very simple and pleasing electro-chemical experiment which may be readily tried by any one having one or two batteries, or a small dynamo or magneto-electric machine, and figures of various kinds may be produced by the same process in brilliant colors.

To produce the rings, all that is required is a Bunsen or Grenet battery in good order, a strong solution of acetate of lead (sugar of lead) and a steel or nickel

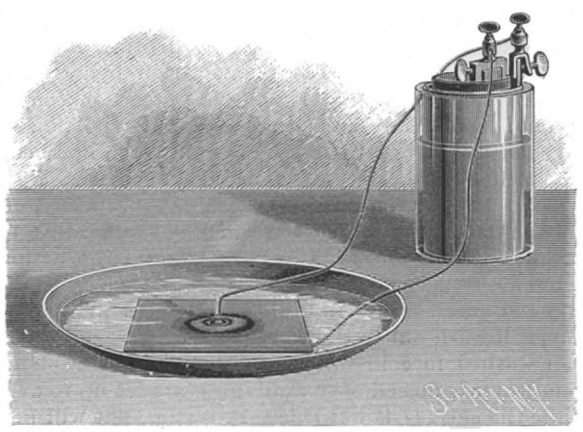


Fig. 1.—PRODUCTION OF NOBILI'S RINGS.

plated brass plate. The lead solution is placed in a common saucer, the steel or nickeled plate is placed in the bottom of the saucer and connected by a wire with the zinc pole of the battery, and the end of the wire, which is connected with the carbon pole of the battery, is held near the steel plate without touching it, as shown in Fig. 1. In a very short time a spot of color will appear on the plate, and in a minute or so the spot will spread rapidly and form concentric rings of prismatic colors, as shown in Fig. 2. A few trials will enable the operator to determine the time required for the production of the best effects. When the operation has proceeded far enough, the plate is removed from the solution, washed in clean water and dried. The beautiful color effect is due to the decomposition of the light by the exceedingly thin film of peroxide of lead deposited on the surface of the plate. It is quite permanent, and serves to protect the surface of the plate from oxidation.

To secure the best results, the plate should be highly polished and the lead solution should be filtered.

By providing anodes of different forms, various ornamental figures may be produced on the surface of the plate. For example, a wire bent into the form of a letter or figure of any form may be used as an anode for producing a figure of the same general form on the plate. As it is sometimes difficult to hold the anode in the proper position, ordinary insulated wire (magnet wire) may be used. This permits of placing the anode down upon the plate, the insulation serving to prevent direct electrical contact.

Very beautiful effects may be secured by cutting an anode of the desired shape from sheet copper and bending parts so as to vary their distance from the plate as in the case of the cross, Fig. 2. The result is that the film is deposited in beautifully graduated colors at the extremities of the figure, the arrangement of colors bearing some resemblance to those of a peacock feather.

The arrangement of the colors in these films is that of the solar spectrum. Nobili's rings resemble Newton's. The colors are fully as intense and more readily seen.

Nobili discovered this phenomenon in 1826. Since that time many modifications of the process have been devised, and some commercial applications have been made. It has been used to some extent in the ornamentation of small objects, such as buttons, articles of jewelry, etc., imparting to them an iridescence which cannot be imitated by any artificial coloring.

Becquerel suggested a solution for this purpose, the formula of which is as follows: "Dissolve 200 grammes of caustic potash in 2 quarts of distilled water, add 150 grammes of litharge, boil the mixture for a half hour, and allow it to settle. Then pour off the clear liquor and dilute with its own bulk of water."

This solution is adapted to other metals than those above mentioned, but the acetate of lead solution yields very satisfactory results and is sufficient for experimental demonstration. In conducting these experiments the poisonous nature of the solutions should be borne in mind.

HORIZONTAL TRIPLE EXPANSION ENGINE.

We illustrate a triple compound horizontal engine constructed by Messrs. Tangyes, limited, Cornwall Works, Birmingham. *Engineering*, to which we are indebted for our engraving, says: The cylinders are respectively 8 inches, 11½ inches, 16½ inches in diameter by 18 inches stroke, and drive cranks set at angles of 120 degrees. The cut-off to the high pressure cylinder is controlled automatically by the Tangye-Johnson expansion gear direct from the governor; the cut-off to the intermediate and low pressure cylinders is not variable, ordinary Trick-ported valves being used.

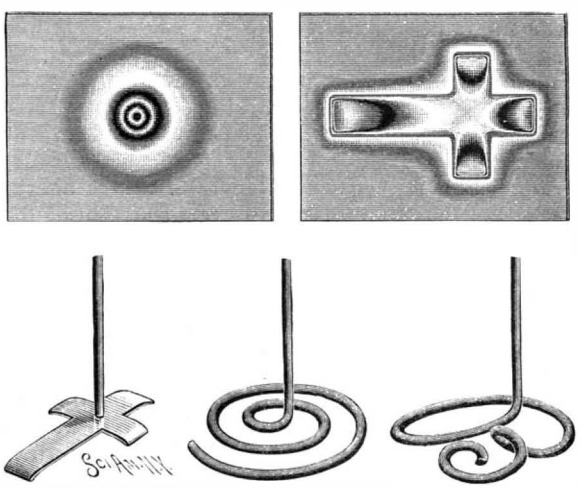
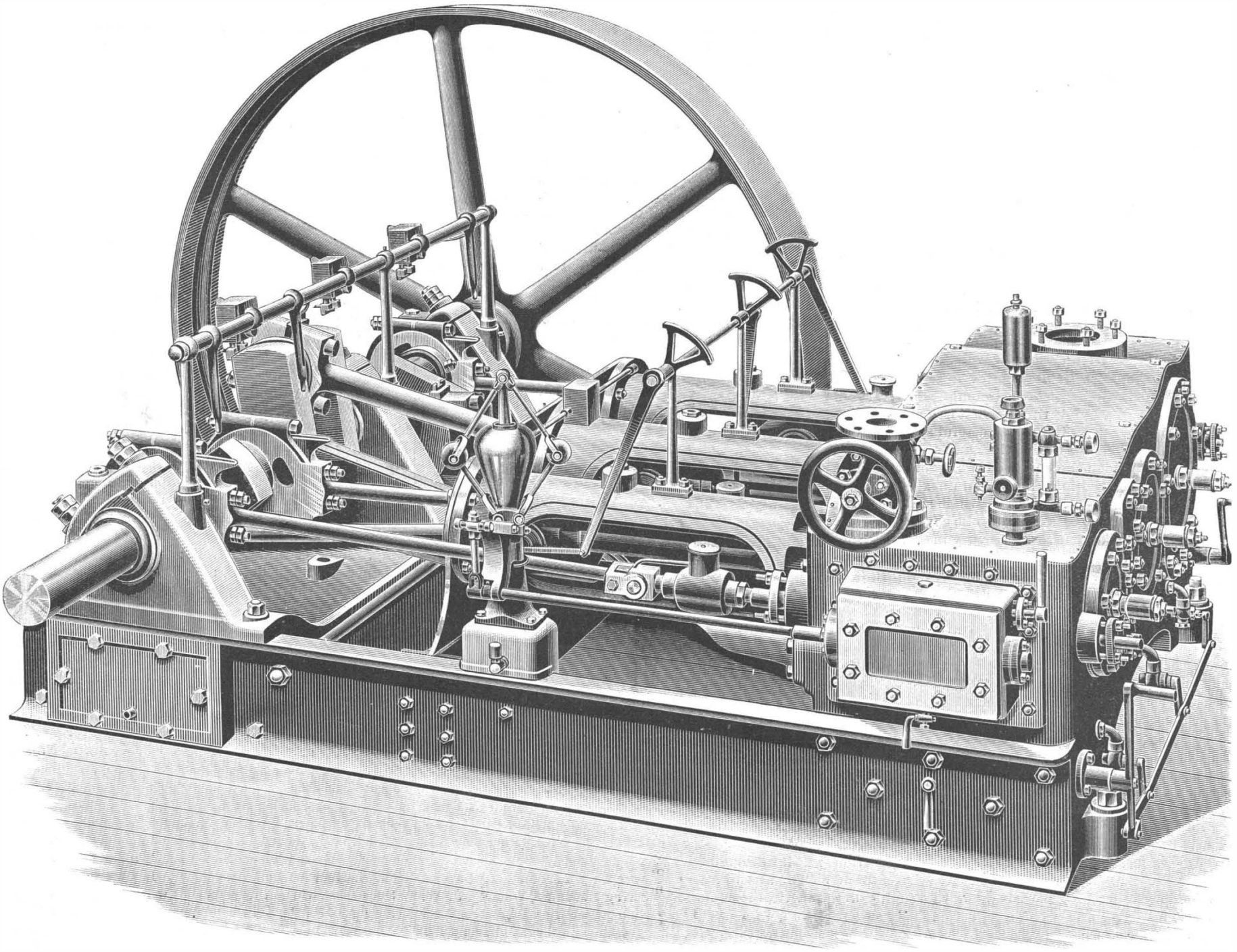


Fig. 2.—METALLO-CHROMES AND ANODES.

All the bearings and wearing surfaces are of liberal proportions. The main and crank pin bearings are lined with anti-friction metal. As this type of engine is often required to run continuously for hours without stopping, the oiling arrangements for all the moving parts are suitable for these conditions. One of these engines was tested at the Cornwall Works in March, 1889, making several continuous runs of three to five hours; diagrams were taken at frequent intervals, and the feed water carefully measured. The temporary boiler then used was rather small, and the fire had therefore to be forced, so that no coal record was kept.

The results work out to 18·6 lb. of water per indicated horse power per hour when indicating 96·8 horse power and running 141 revolutions per minute. The load was applied to two friction brake wheels 7 ft. 6 in. in



HORIZONTAL TRIPLE EXPANSION ENGINE.

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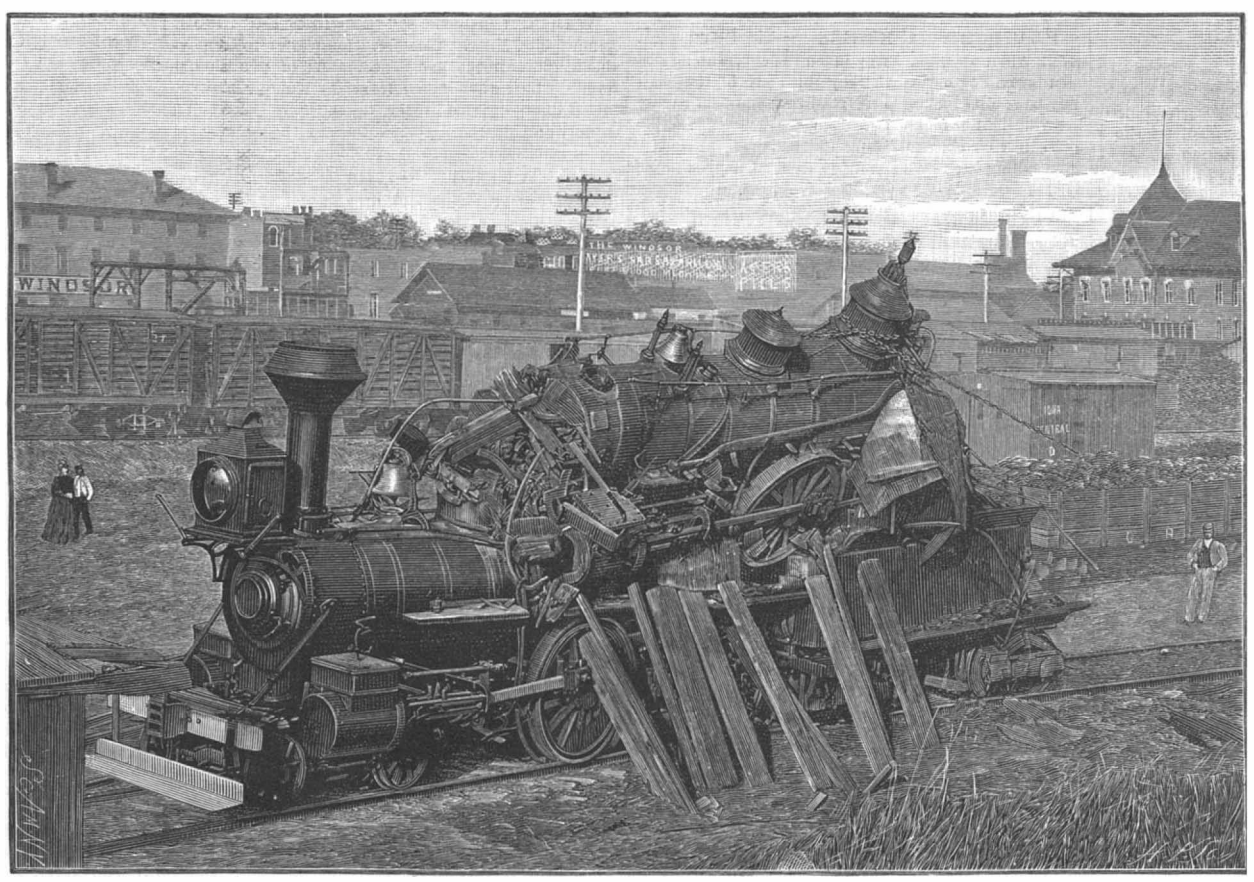
diameter by 12 in. wide, one on either side of the engine. The rims of these wheels were made with internal flanges, and were kept cool by water.

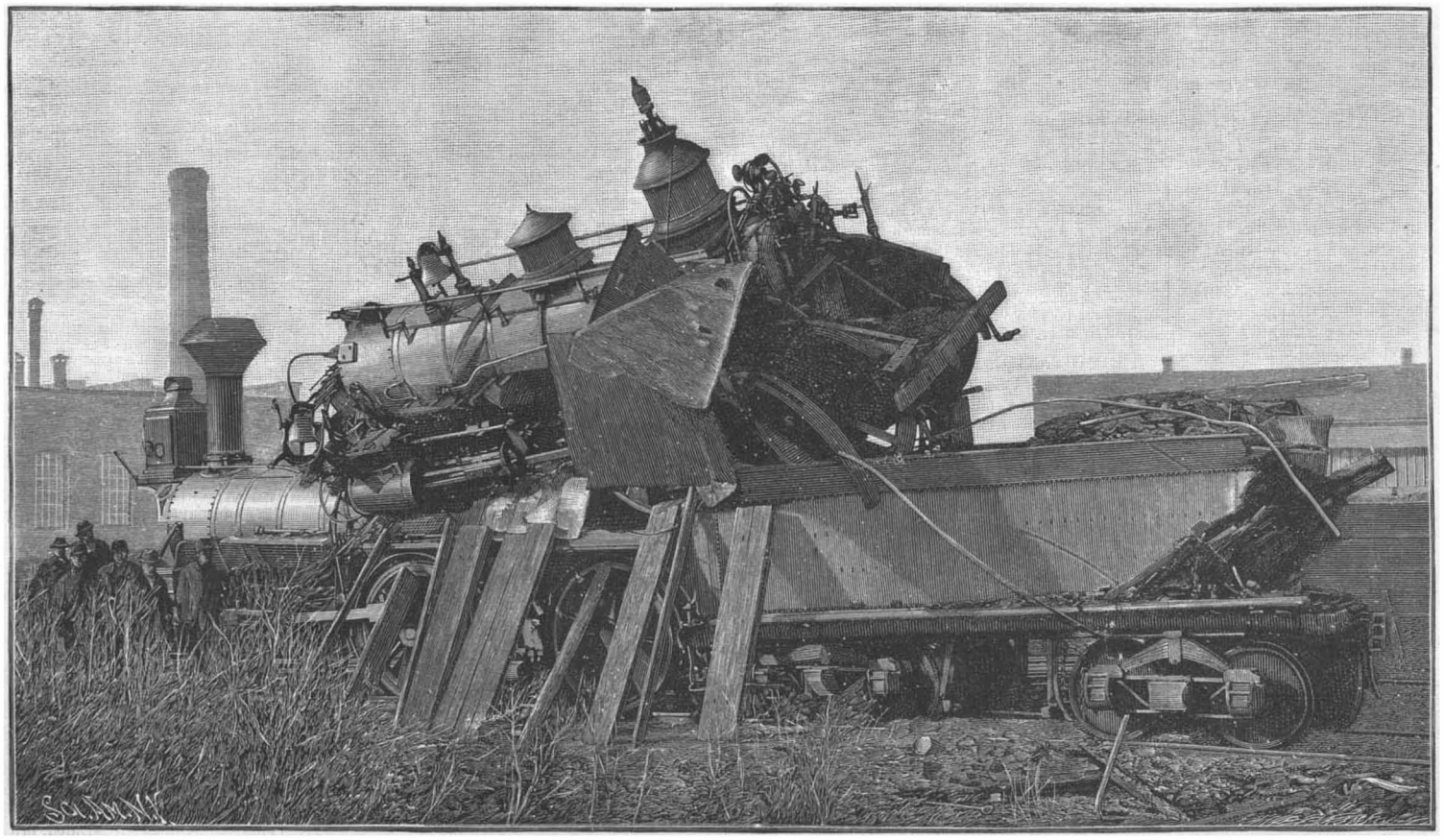
When desired, these engines are placed under locomotive boilers constructed for a working pressure of 165 lb. per square inch; the smokebox resting upon a pedestal fitted to the cylinders, and the ashpit being bolted between the channel irons, which are prolonged beyond the crankshaft bearing.

A Tangye duplex boiler feeder, supplying the boiler, is fitted to the ashpit casting alongside the firebox, in order to leave free access to one side of the engine. One end of the crankshaft is lengthened; a single large flywheel and an outer bearing are supplied. The even distribution of power which is attainable with this class of engine, and its steady running at high speeds, commend it for extensive use where these qualities are of importance.—*Engineering.*

REMARKABLE RAILWAY COLLISION IN IOWA.

The accompanying illustrations, reproduced from pictures made by Mr. Theodore A. Brown, a photographer of Marshalltown, Iowa, represent the curious result of a railway collision which took place in that neighborhood, on the Iowa Central Railroad, on October 30. The accident, if such it may be called, was caused by "a mistake in train orders," and two men were seriously injured, but no one was killed. The crews of both engines jumped just before the collision. A regular freight train was going west with orders to "run regardless of all trains," when a switch engine, with two empty flat cars, was ordered to back east for some miles on the same track, to take on a load of stone. The two trains met, both running at a high rate of speed. The engine of the westward-bound freight train made kindling wood of the two flat cars that were backing east, then made almost a clean jump over the tender of the other locomotive, and landed upon its back. The lower engine and tender did not leave the track, although its tank was knocked loose, and in the position shown both engines were hauled back to the station at Marshalltown. The coal in the tender took fire, and was burning fiercely when the two engines reached the station.





REMARKABLE RAILWAY COLLISION IN IOWA.

Dangers to Street Car Motors by Lightning.

The *Electric World* says: We recently received from a correspondent a very instructive account of a singular accident from lightning, which happened the past summer, on a Sprague electric road of moderate size. The vulnerability of railway apparatus to lightning has been the cause of considerable loss to the various companies, more especially as the dynamo is subject to injury, but now and then armature and field coils on cars are burned out from the same cause. So far as the dynamo is concerned, the powerful shunt winding has a tendency to force the discharge through to the core of the armature instead of choking it as is ordinarily the case with a series-wound motor. On the particular occasion to which we are referring, a severe thunder storm occurred while the cars were out upon the line. Now the road in question has rather severe grades, produced by a series of ridges over which the road passes in succession.

During the course of the storm the trolley wire was struck by lightning at a time when three of the cars were running down grade on three of the ridges before mentioned by gravity alone, the current having been cut off as usual. The other cars were in motion several of them on heavy grades. The result of the shock was to disable the three cars that were running down grade and to leave the others quite unharmed, although from their position they were at least as much exposed as the injured ones. On subjecting the damaged cars to a careful examination it was found that the injuries received by them were almost precisely similar. In each case the "A" coil was the one damaged, and injury had occurred by the discharge from the coil to the magnet core. The cause of this selective injury of the three cars running down grade is not far to seek.

In the method of field commutation employed the "A" coil, as is well known, remains always charged, even when the motor is not running. Consequently when the lightning got upon the trolley wire it was free to pass down into the motors, and then broke through the insulation and jumped across to the cores. In the cars that were running, this discharge was checked by the high self-induction of the magnet coils, and what small amount could pass through was free to go to earth without injury to the motor. In the cars where the current was shut off, however, there was little of this checking action, and consequently the lightning jumped across to the core and went to the earth. The electrical superintendent of the road in question, who is more than usually ingenious in the matter of repairs, saw the point of the accident at once and promptly changed the connections, so that the "A" coil should not be charged when the motor is not in action, but should be cut off at the switch box. Since that time the line has not been struck, so that the efficiency of this arrangement has not been tested, but the arrangement certainly lessens the likelihood of damage to the motors.

THE latest and fastest, for her size, torpedo boat is the Bathurst, built by Yarrow & Co., London, for the Argentine government, 130 feet long, 13½ feet beam. Displacement, 76 tons, with load of 14 tons. Locomotive boiler, with heating surface of 1,500 square feet. Makes over 8 tons of steam per hour, 200 pounds pressure. Consumption of fuel, 2½ pounds per horse power per hour. Engine—four cylinders, on the quadruple expansion plan, 1,230 indicated horse power. Cylinders, 14, 20, 27, 36 inches, 439 revolutions, maximum 500 revolutions per minute. Average speed of two hours' run, 24·426 knots, or 28·1 statute miles per hour. Maximum speed on measured mile, 26·086 knots, or a little over 30 miles per hour

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RECENTLY PATENTED INVENTIONS.

Engineering.

ENGINE GOVERNOR.—Martin A. Green, Altoona, Pa. This governor is of a class which have a laterally movable eccentric upon the crank shaft of the engine, centrifugal weights operating in connection with centripetal springs to vary the position of the eccentric, the invention covering an improved construction whereby the force exerted by the springs may be readily and accurately adjusted with reference to the opposing force exerted by the centrifugal weights.

LOCOMOTIVE EXHAUST NOZZLE.—John J. De Lancey, Binghamton, N. Y. This nozzle has an unobstructed open upper end, and in connection therewith is employed a flat plate having an unobstructed opening of the same size as the nozzle outlet, to one side of which it is pivoted to vibrate horizontally across it, its swinging motion being under the control of the engineer in the cab, whereby the exhaust may be regulated, thereby regulating the draught in the boiler.

WHEEL FOR ROAD ENGINES.—Rescue B. Page, Oakland, Cal. This wheel is so made as to prevent the sinking into the ground of the shoes used with it, also providing means whereby one of the shoes will at all times be in contact with the ground, and whereby the shoe to be lifted will be elevated first at that end facing the line of travel of the wheel, thus reducing suction.

BOILER LEVELER. — Ole O. Kravik, St. Carl, North Dakota. This invention provides a construction specially designed for portable boilers, to raise and lower their front ends when going up or down a grade without interfering with the turning of the front wheels, the devices therefor being simple, durable, and easily manipulated.

Railway Appliances.

CAR COUPLING.—Benjamin J. French and John H. Carroll, De Smet, South Dakota. The drawbar of this coupler is made in two hinged sections capable of lateral movement, the outer end of the bar terminating in a coupling hook, while a spring is attached to the drawhead and the hinge of the drawbar, and a shaft has a chain connection with the drawbar, the device being designed for use with the ordinary drawhead, to be manipulated from the top or sides of the car, and for coupling with an opposing coupler of greater or less height.

CAR COUPLING.—William H. Franks, Sonora, Texas. This is a coupler of simple construction, to be manipulated from the top or sides of freight cars and from the sides or platform of passenger cars, the drawhead having an upwardly extending post in which is fulcrumed a lever, combination with peculiar forms of lock and link lifts, and various other novel features.

Mining, Etc.

CRUSHING ROLLS AND APPARATUS FOR REDUCING ORES.—Daniel Brennan, Jr., Bayonne, N. J. Three patents have been granted this inventor for radical improvements in machines for the reduction of ores, the crushing rolls of which comprise fixed and yielding rolls, the yielding rolls carrying pulleys and ropes provided with weights, there being a spring cushion for the weights, and screw rod stops of improved construction for the yielding roll, etc., whereby the rolls will have a steady and uniform pressure, but will yield should a drill point or other like article be passed in with the ore. For use in connection with the rolls a series of separator screens is provided, common to all the rolls, with conveying mechanism between the rolls and screens. The screens of the apparatus form receivers for the coarse products or tailings of each of the rolls, as well as distributers for the delivery of the tailings to the several rolls, thus facilitating the more speedy and economical reduction of the ores by assorting the material after its initial breaking, with special reference to the adjustment and capacity of the several rolls, the material being reassorted and redistributed to the rolls until reduced to the requisite degree of fineness. The feed regulator provided for use with these mills, though also capable of use for other purposes, has two superposed slides, arranged after a novel manner, and formed of sectional slides made up of relatively movable strips or individual slides, by means of which the ores, either coarse or fine, may be fully under the control of the operator, and the feed may be varied to supply more or less material at any particular point, or entirely cut off the supply at any point, the main object being to prevent any uneven wearing of the roll.

Mechanical.

PLATE PRINTING PRESS.—Wellington P. Kidder, Boston, Mass., and George H. Kendall, New York City. This invention relates to presses in which the inking, wiping and polishing of the plate are performed automatically, and provides improved mechanism for the wiping and polishing, and means for shifting the web over the face of the wipers and polishers, whereby the cloth will be applied in both services in both the forward and back stroke of the plate, while a perforating mechanism is provided in combination with the other improvements.

TOOL FOR DRESSING EMERY WHEELS.—Anson A. Reed, Worcester, Mass. In this device the shaft on which the cutter head is mounted is screw threaded between journals and has a collar, the cutter head consisting of a series of cutters and spacing collars clamped together by rivets or bolts and screw-threaded interiorly to fit the shaft, the tool being adapted for use by hand or in the tool post of a lathe or similar machine.

SHOE TURNING MACHINE. — Jason H. Edgerly, Chicago, Ill. This machine has a hub pivoted on a support and provided with radially extending forms, which are changed to fit the varying sizes of shoes, a curved arm extending from the upper portion of the hub having its lower end opposite the toe of a form, to facilitate quickly turning shoes made as "turns" right side out.

Agricultural.

CUTTER BAR FOR HEADERS.—Charles E. Plumtree and Louis A. A. Tonnet, Spokane Falls, Washington. This is a double cutter bar for a harvesting machine, a pitman connected with a lever operating one of the cutter bars, the other cutter bar being operated by another lever formed of two members united by a sliding connection, each of the members having a separate fulcrum, and the two-part lever being connected to and operated by the first lever.

Miscellaneous.

TAILORS' STOVE.—George Hay, Picton, Canada. This is a compact and convenient stove for quickly heating tailors' irons, the fire chamber having apertured side plates connecting with vertical side flues which intersect a horizontal flue above the side walls of the fire chamber, the stove being principally formed by readily assembled cast iron plates.

PLATFORM ROCKERS. — Richard H. Krall, Allentown, Pa. This invention covers an attachment providing means whereby the body of the chair may be readily locked to the platform, and held rigidly in an upright or inclined position, the device also acting as a safety check, preventing the body of the rocker from falling backward should an accident happen to the spring.

ADJUSTABLE SWING. — William K. Miller, Troy, Kansas. Two doubled ropes are used in this swing, and the seat board has a shaft projecting from each end carrying a locking sleeve adapted to retain a rope end, with other novel features, whereby the swing may be readily adapted for height to suit different persons.

WINDOW SCREEN.—Christian C. Schupbach, Grand Island, Neb. This is a wire cloth device, applicable either in a stationary or sliding form, and which can be readily put in position, being adjustable for windows of different widths, while it is designed not merely to exclude flies, but to allow for their escape without letting in others.

DRAWER ATTACHMENT. — Edward W. Stone, Chicago, Ill. This is a stop attachment in which a novel form of angle iron turning in a socket is so applied that the drawer may be pulled outward essentially its entire width and yet sustained against falling from the cabinet, it being possible also to remove the drawer from its place when desired without disturbing the attached device.

WATER WHEEL. — Thomas A. McDonald, Durham, Canada. This is an improvement in wheels adapted to be anchored in a stream, whereby the force of the current may be utilized to drive machinery, and the hub of the wheel is divided into vertical clutch sections between which are introduced tongue-like extensions of paddles of peculiar form, having pockets thereon.

FOOT REST.—John K. Phillips, South Orange, N. J. This is an improved article of manufacture designed especially for use in shoe stores in the fitting on of shoes, giving increased convenience with economy of space, and there being in connection with the foot rest a sliding knee rest for use by the salesman, the latter rest being moved into the foot rest when not required for use.

KNITTING SEINES, ETC. — Nathaniel D. Sollers, Sollers, Md. This invention covers an improvement on a former patented invention of the same inventor, and provides a new mesh plate for the use of seine knitters in forming the loops or meshes of the seine, being designed to permit of the formation of the weaver's knot by what is known as the French method by a single passage of the needle in a rapid and convenient manner.

PERMUTATION LOCK. — Alphonse Metzger, Milton, Pa. Combined with a tubular lock case having a longitudinally grooved portion and annular external grooves are radially apertured rings having interchangeable pins projecting their apertures into the grooves, and a bolt having a notched edge to be engaged by the inner ends of the pins, with other novel features, the lock being so constructed that the bolt may lock various devices.

PIKE POLE. — Alfred E. Creigh, Ronceverte, West Va. This invention provides a socket piece for the end of the pole, and a pike or point having its shank formed to fit the socket, and so that it may be easily slipped in or removed therefrom when the clamping band is removed, whereby the point may be readily renewed when it becomes dulled.

PAVEMENT. — Frederick C. Schmidt, New York City. This invention provides a form of construction by which a pavement may be readily laid, and designed to prevent sagging of the paving blocks, which are laid between the transverse ribs of cast metal plates, the ends of these plates having flanges which rest in channels in the top of supporting beams laid on the ground.

FUNNEL.—William R. Cole, Pottsville, Pa. This is a device designed particularly for filling oil lamps, and for other uses where the filling up of the vessel cannot be readily observed, there being combined with the funuel tube a float and indicator to be lifted by the liquid when the vessel is full or nearly so, the float being attached eccentrically to a rod movably attached to the spout.

ATOMIZER.—Josef Schoettl, Brooklyn, N. Y. The spray pipe of this device is secured to a neck piece on a coupling head by a rib and groove connection which permits the pipe and its nozzle to be rotated on the neck piece, the atomizer being designed to facilitate the spraying of medicinal liquid preparations within the head and throat, and being a compact device, readily separable into its component parts.

DENTAL MALLET.—William H. Dibble, Brooklyn, N. Y. This mallet has a plugger at each end, with means for pneumatically delivering a blow simultaneously on each plugger, so that one blow neutralizes the other, the handle remaining stationary, and the entire effective force of the stroke being imparted to the pluggers.

VEHICLE WHEEL. — Victor F. Mogk, Seattle, Washington. This wheel has an inner tire with an annular channel in its periphery, and an outer elastic tire, with springs interposed between the tires, whereby the percussion resulting from travel is absorbed, and shock or jar is obviated, the tires coming together when the wheel is subjected to excessive weight.

FENCE. — Aaron F. Dickey, Friedens, Pa. This is a truss-supported fence of novel construction, whereby the fence may be raised to any desired height by drawing on the ends of the truss wire, and a span of fence from ten to twenty rods in length may thus be held up.

ORNAMENTAL NAIL HEAD. — Otto F. Wegener, Seattle, Washington. This is an improvement in ornamental hangers designed for use as picture nails, nails or screws for supporting brackets, etc., against the wall, the invention covering a novel form and combination of parts.

WINDOW SCREEN.—Thomas Robinson, Minneapolis, Minn. This invention relates to removable window screens, and is composed of two similar frames which when taken from the window may be folded to occupy small space, the screen in place being entirely outside the sash, so that the latter may be raised and lowered without interfering with the screen.

MOP WRINGER.—John Frost, Omaha, Neb. This is a simple and durable device for easily wringing a mop without soiling the hands, while at the same time the pail or bucket is not liable to be upset.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION.

JANUARY NUMBER.—(No. 63.)

TABLE OF CONTENTS.

1. Handsome colored plate of an elegant residence on Riverside Avenue, New York City. Cost $60,000 complete. Floor plans, two perspective elevations, etc. Mr. Frank Freeman, New York, architect.
2. Plate in colors showing an attractive cottage at Maplewood, Chicago. Estimated cost $3,000. Perspective view and two floor plans.
3. A cottage at Rutherford, N. J., erected at a cost of $6,000 complete. Perspective elevation, floor plans, etc.
4. An elegant residence at Chestnut, Hill, Pa., recently erected for Mr. Alfred C. Rex. Cost $30,000 complete. Floor plans, perspective elevation, etc.
5. Sketch and floor plans of a residence at Stockton, Cal. Estimated cost $10,000.
6. Cottage at Englewood, Chicago. Perspective view and floor plans. Cost $4,200.
7. Residence on Powelton Avenue, Philadelphia, Pa. Cost 30,000 complete. Architect Thos. P. Lonsdale, Philadelphia. Floor plans, perspective elevation, etc.
8. A cottage at Jackson Park, Chicago. Estimated cost $4,000. Floor plans, perspective elevation, etc.
9. Cottage on Munroe Avenue, Chicago. Two floor plans and perspective view. Cost $900.
10. Residence at Wayne, Pa., from plans prepared by W. L. Price, architect, Philadelphia, Cost $7,000 complete. Floor plans, perspective view, etc.
11. An attractive country church of moderate size recently erected at Glen Ridge, N. J. Estimated cost about $15,000. Perspective view and floor plan.
12. Cottage at Lakeview, Chicago. Floor plans and perspective view. Cost $3,000.
13. A stable combining both beauty and convenience, erected for Mr. A. C. Rex, at Chestnut Hill, Pa. Cost $1,800. Plans and perspective.
14. A cottage at Austin, Chicago, Ill. Cost $4,200. Two floor plans and photographic view.
15. Sketches of park entrance lodges.
16. Engraving of the Woman's Temperance Temple, Chicago, Ill., as it will appear when finished. Estimated cost of the Temple $1,100,000.
17. View of Whitworth Memorial Hospital.
18. Miscellaneous contents: The marble industry.—Lighting streets of London.—Mahogany ties and marble bridges.—Staining floors.—The Peruvian temple of Pachacamac.—How to catch contracts.—Black birch.—Some of the merits.—Improve your property.—The SCIENTIFIC AMERICAN a help to builders.—An improved article for plastering, tiling, and cement work, illustrated.—The Sinclair double rocker, illustrated.—An improved veneer press, illustrated.—Our last year's volume.—The Albany Venetian blinds, illustrated.—A convenience for hospitals, families, etc., illustrated.—The education of customers.—The Buffalo hot blast heating system, illustrated. — The "Willer" sliding blinds, illustrated.—Mueller's water pressure regulator.—Artistic wall decorations.

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Canadian and other foreign patents of the Worcester chemical fire pail for sale. See illustrated article on page 5. Address the Worcester Fire Appliance Co., Worcester, Mass.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(2660) E. J. E. asks: 1. What will preserve a proof of a photograph to keep it from fading? A. Dip the proof in a solution of hyposulphite of soda, 20 grains, dissolved in 5 ounces of water for ten minutes, then wash in changing water for two hours. 2. How should a young Canary bird be treated as to food, and the best method in teaching to sing? A. We can supply yon with "Canary Birds, a Complete Guide for their Breeding, Rearing, and Treatment," price 75 cents. Also "The Canary Book, containing Full Directions for the Breeding, Rearing, and Management of Canaries, etc.," by Wallace; illustrated, price $2.

(2661) C. R. asks why gas formed in an explosion of coal gas, *i. e.*, the exhaust of gas engines, is not used for inflating balloons, as I should think it necessarily would be lighter than coal gas. A. It is not only heavier than coal gas, but is heavier than air. It consists of carbon dioxide and nitrogen; the vapor of water condenses immediately, leaving the other two gases.

(2662) A Subscriber asks: Is the film of incandescent lamps a kind of carbon? A. Yes.

(2663) A. M. F. asks for the best formula for making "blue print" solution.—A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 584, for full directions.

(2664) S. A. R. asks: Can you tell me how to transfer prints, etc., on an enamel surface, so that they may be fired? A. See Henderson's method in SCIENTIFIC AMERICAN SUPPLEMENT, No. 382.

(2665) Health Officer asks: Do you know of any process for the destruction of the gases and smoke emerging from stacks resulting from burning copper ore and evolving large quantities of sulphur and sulphurous gas? A. There is no practical way of

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disposing of the trouble you mention. In some places the gases are saved and made into sulphuric acid, but this we presume does not apply to your case. If a water tower could be used, so as to wash the escaping gases, some improvement would be effected.

(2666) R. asks how to run white wax gums out in cubic form, while the paraffine is hot and melted. We have tried iron, glass, marble, wood, and tin, but find it sticks to them all. A. Use powdered starch. Place it in a tray and form the mould by pressing down into it a cube of wood, slightly tapered to make it "draw."

(2667) Subscriber asks for a recipe for replating knives, Rodgers' make A No. 1. A. In our SUPPLEMENT, No. 310, you will find electro-plating decreased. Steel should receive a light deposit of copper before silver plating.

(2668) A. B. F. asks how to make a glue or cement which will hold copper and zinc filings to leather when exposed to dampness or water. A. Try shellac and alcohol, or varnish the surface with copal or other varnish, and when tacky sprinkle on the filings.

(2669) A. T. O. asks: 1. What is the present market price of aluminum, and how much of it is there in a cubic foot of common blue clay? A. The price depends on the quantity. It is about $4 a pound. The quantity in clay varies. It may be fifty per cent, generally it is much less. 2. How much carbon dioxide results from the complete combustion of 1 gallon of good kerosene? A. About 18 pounds. 3. I have applied strong water of ammonia to the red spots formed on a woolen coat by nitric acid, but it does not remove them. What shall I do? A. You cannot remove them except by instant application of ammonia. Any delay makes them ineradicable. 4. Would it be dangerous to grasp a "live" electric wire with both hands at once if the feet do not touch the ground or any other conductor? A. Not under ordinary conditions; it might be unpleasant. 5. Does increased speed in a dynamo result in increased voltage? A. Yes. 6. Is there anything in the following: "Smokers will be glad," says *Invention*, "to hear that tobacco may be enjoyed to any extent without injury to health. Dr. Gautrelet, of Vichy, has discovered that by inserting in the pipe or cigar holder a piece of cotton wool steeped in a solution of pyrogallic acid, all the ill effects of nicotine will be neutralized. The mischief frequently caused to heart, mouth, and nerves is thus prevented, while the taste of the tobacco remains unaffected." A. We do not know. We doubt it.

(2670) F. E. A. asks: 1. Is there any way you know of in which kid gloves can be cleaned without wetting them, that will work as well as wetting them? A. Stale bread is sometimes used for this purpose. The gloves are put on and the softer part of the bread is broken up into crumbs and the hands are rubbed one over the other as in the act of washing, the crumbs being thus rubbed over all parts of the gloves. Spongy rubber is often used for glove cleaning. It is applied in the same manner as in cleaning drawings, *i. e.*, it is rubbed over the soiled parts of the glove. 2. What are first class lantern slides painted with to produce the greatest transparency and brilliancy without light, etc., affecting the colors? Also how to apply the colors without showing brush marks when enlarged? A. Transparent oil colors are generally used. They are mixed with varnish and carefully applied. Large masses of color are sometimes applied to the back of the glass, where they will be out of focus, and while they tint the picture the brush marks will not show. The finest lantern pictures are tinted with colors insoluble in Canada balsam, and the slide cover is cemented on with balsam.

(2671) B. F. E. asks: 1. How is dry battery compound made, such as is simply dissolved in water, with no other addition? A. The bichromate battery compound is made by mixing sulphuric acid with dry powdered bichromate of potash. As the dust of the bichromate of potash is poisonous, and as the fumes given off during the mixture are deleterious, we would not advise a novice in chemistry to try to make the compound. Special appliances are needed to avoid unpleasant consequences. 2. When wire is said to be burned out, is it consumed or simply destroyed as a conductor, I mean in a small dynamo? A. An armature is burned out when the insulation of the wire is destroyed. In addition to this result of a heavy current, the wire may be fused. 3. How much wire should be wound on a magnet core (such as used for bells) to make it five ohms resistance, No. 28 wire? A. 74 feet, or about ½ ounce. 4. What is the resistance of 50 feet of No. 36 wire? A. About 21½ ohms. 5. Should a zinc and carbon be same size and thickness? A. They need not necessarily be of the same thickness. The carbon may be thicker.

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AND EACH BEARING THAT DATE.

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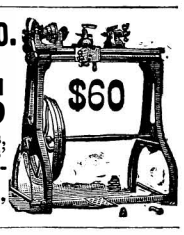

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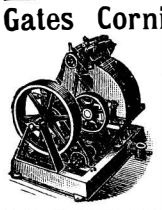

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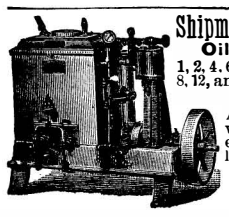

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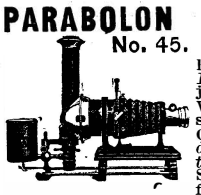

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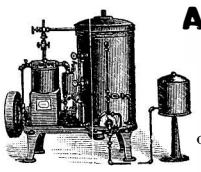

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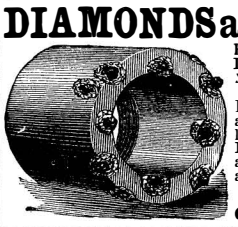

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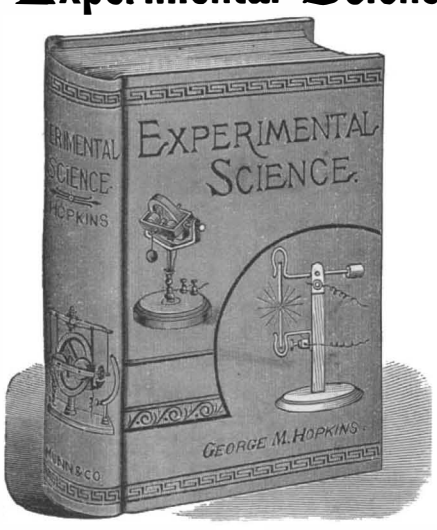

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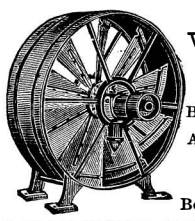

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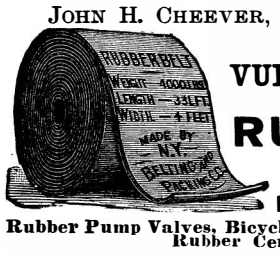

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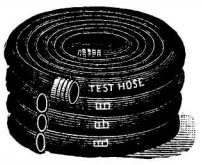

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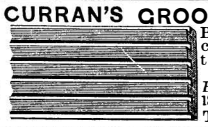

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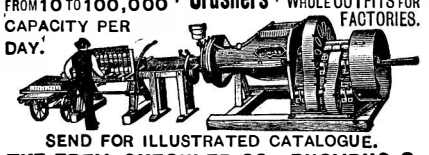

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2. Forms of tender and schedule of conditions and a sketch of the portion of the City showing the streets to be lighted may, on payment of Five Dollars, be obtained from CHARLES HALLETT CLARK, Washington Buildings, No. 1 Broadway, Rooms 209 and 210, New York, who will on application give any further information that may be required.

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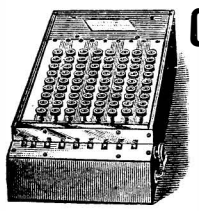

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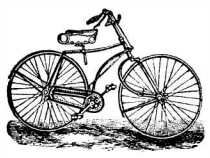

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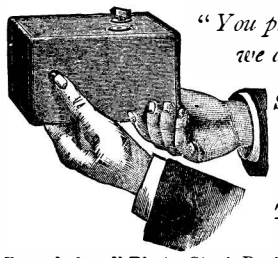

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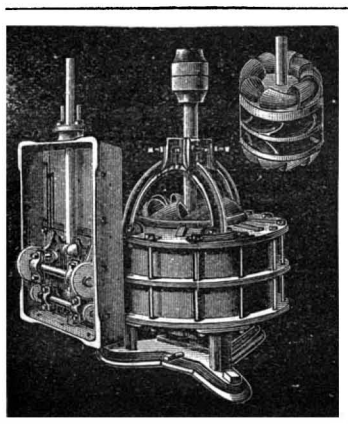

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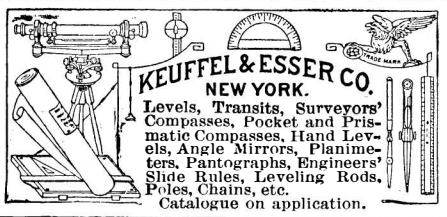

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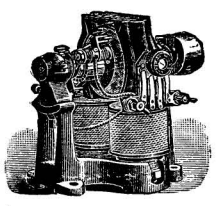

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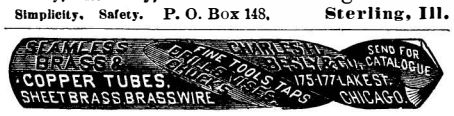

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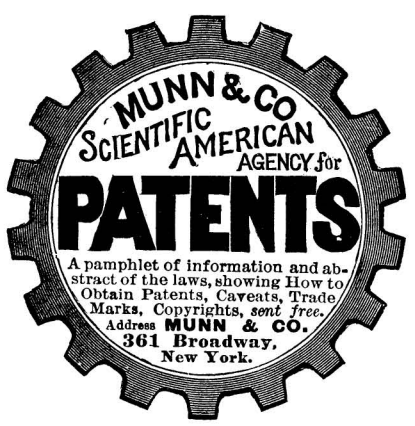
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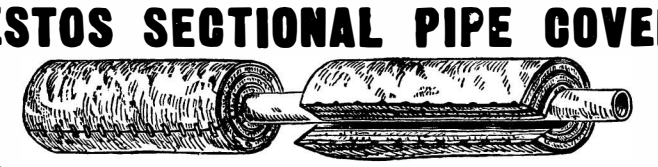

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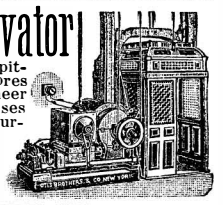

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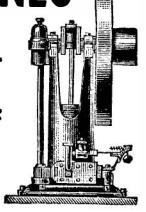

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